THE INDEPENDENT GUIDE TO IBM PERSONAL COMPUTERS

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Volume 4 Number 5
$2.95
March 5, 1985

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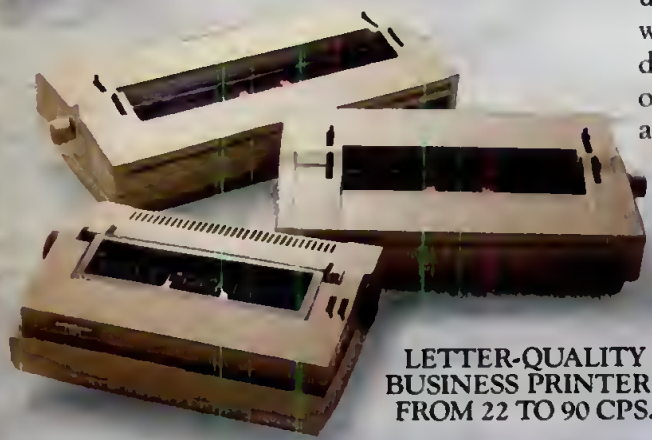

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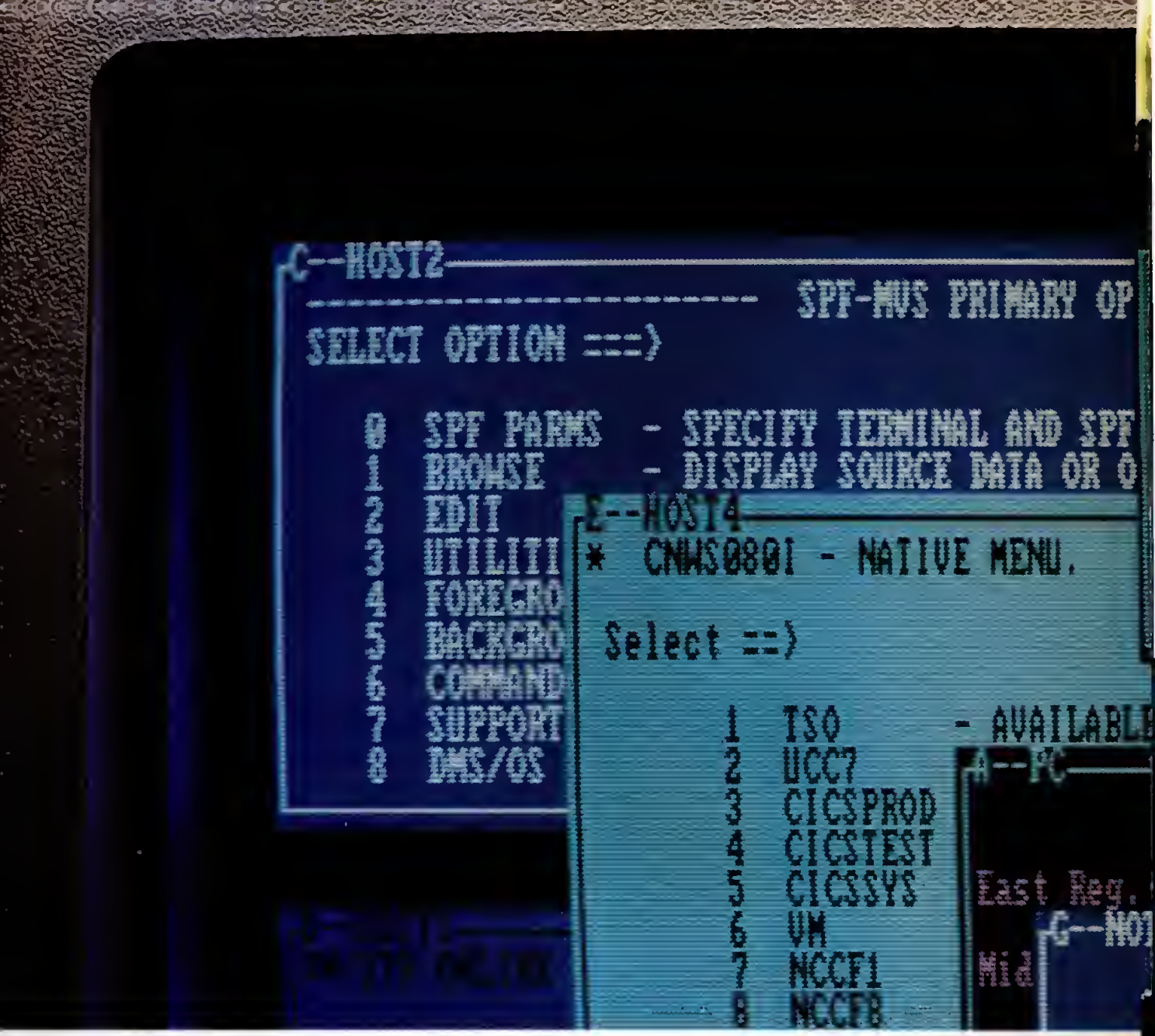

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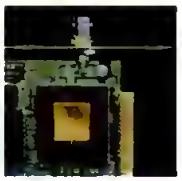

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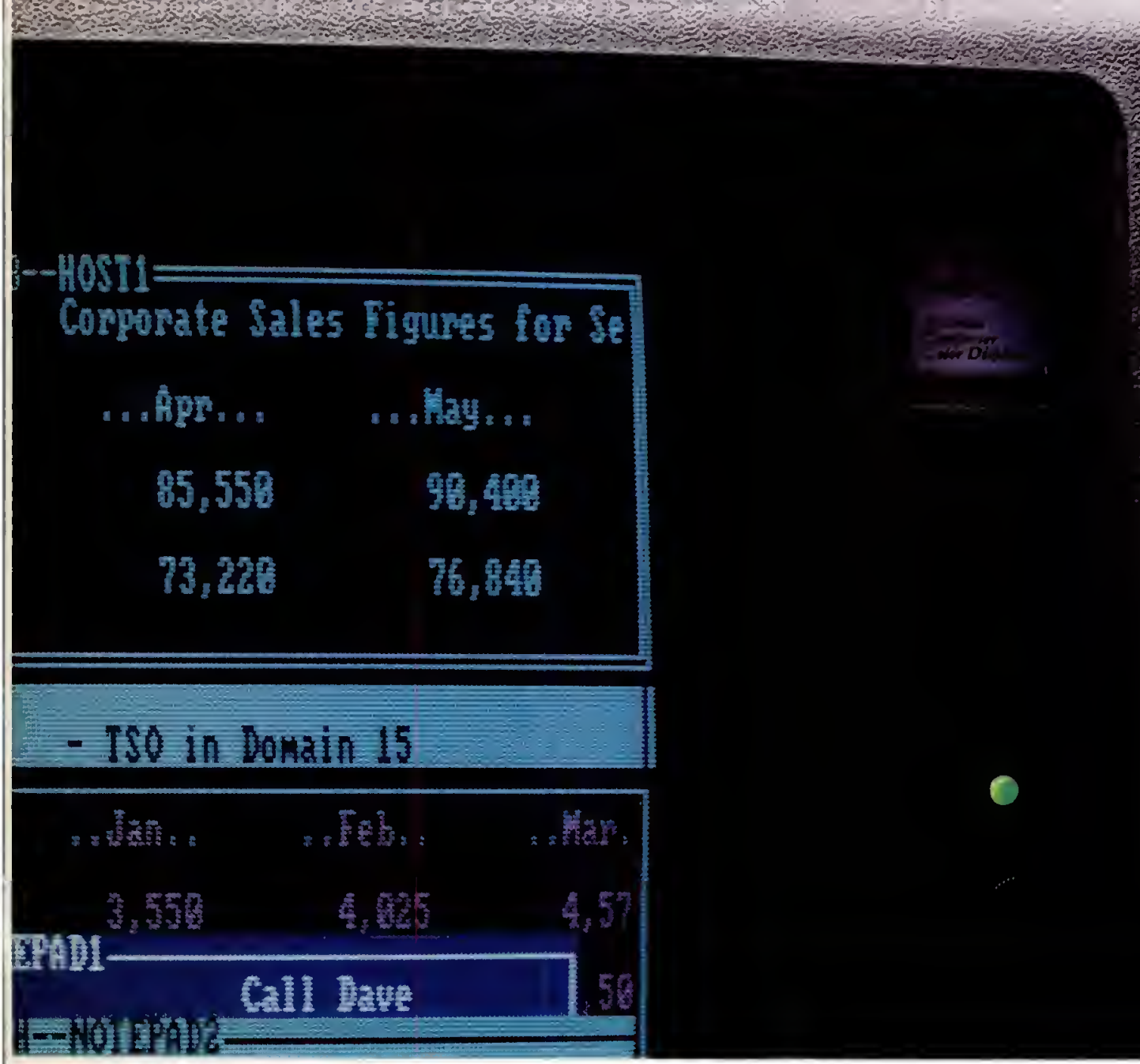

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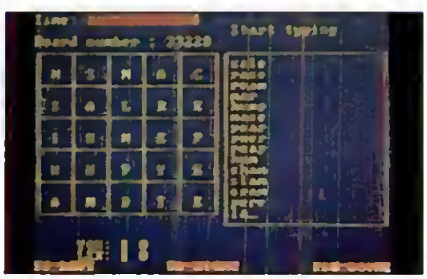

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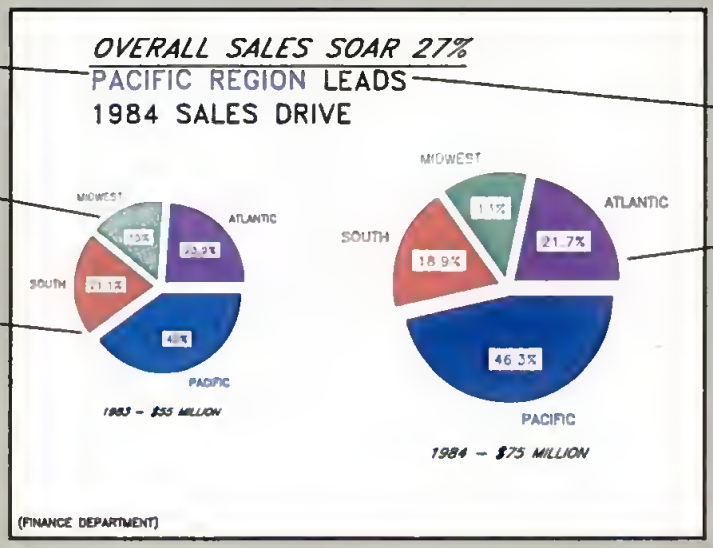

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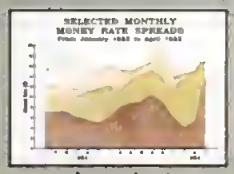
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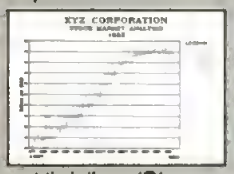
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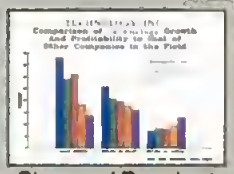
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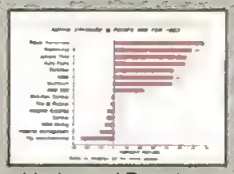
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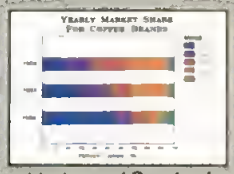
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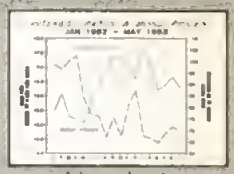
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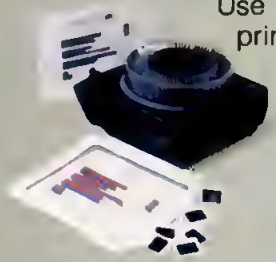

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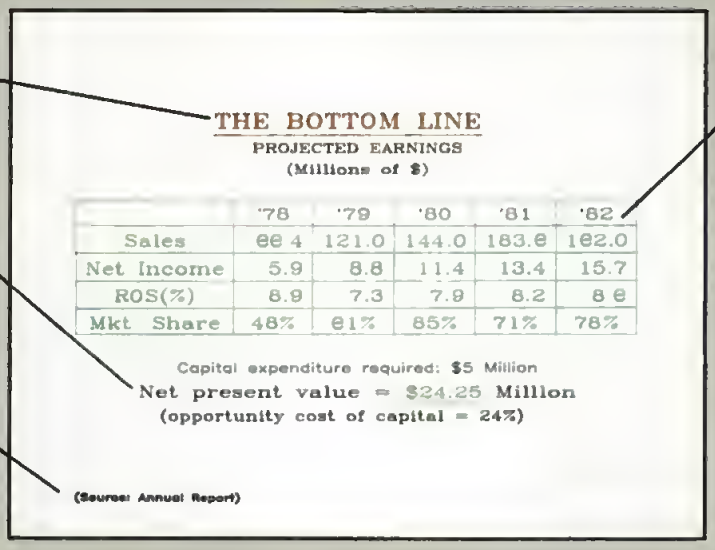

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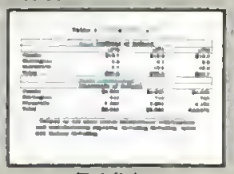
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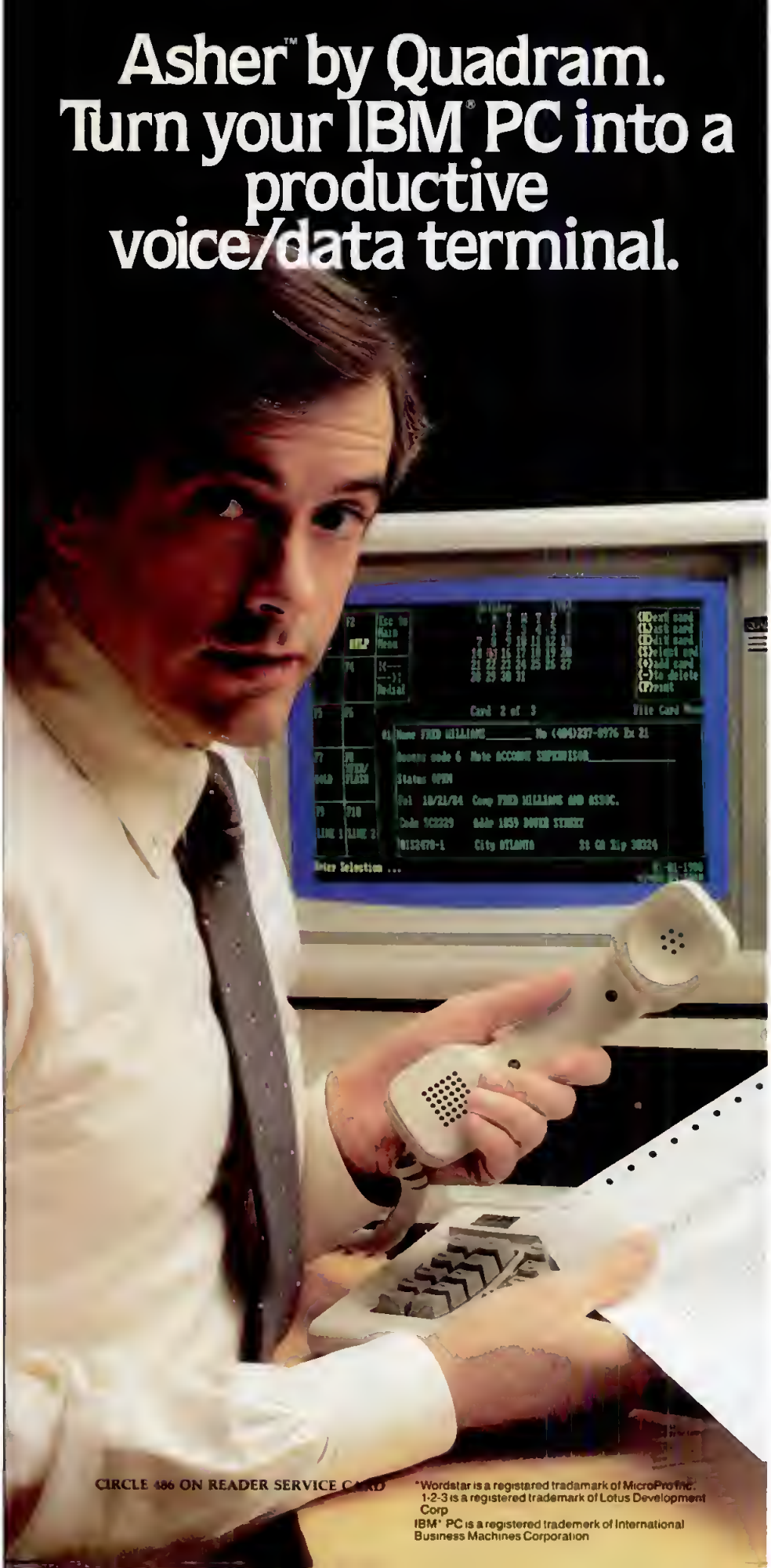

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Now you won't have to wait for the difficult to find hard-disk version of the IBM AT (model 99). You can buy the floppy disk IBM AT (model 68), add our hard disk and tape drive system for about what you'd pay for the AT hard disk upgrade alone. It's almost like getting the tape drive free.

Let's face it, we've all heard the horror stories of people who've lost data on their hard disk. True, it doesn't happen often, but then disaster seldom does. With the amount of data you can put on a hard disk these days, no one in business can afford even a small disaster.

When did you last backup your hard disk?

Oh, you did it once with floppies and it was so time consuming that now you've convinced yourself nothing will go wrong? In other words, it can't happen to you. And besides, at the prices they're asking for tape backup—$2,000 and up—you're willing to take a chance. You've seen some tape drives for less, but you have to buy an expensive hard disk to go with it, and you've already got a good hard disk. Where can you turn for relief?

IBM Compatible tape drive system complete for $995

The Express Systems™ tape drive comes complete—half-high tape drive, controller, and software—for only $995. It's absolutely IBM compatible—all 60 megabytes of it.

You can use your tape drive in the event your hard disk fails. And if you have to replace your hard disk, the tape's ability to read bad sectors will let you replace your hard disk with another even if the new one is not error-free. The tape requires very low power, too.

And it doesn't poke along. It reads and writes at 90 inches per second (ips) and transfers data at up to 3.75 megabytes per minute in the streaming mode. You don't have to be a rocket scientist to figure that you can perform an image backup of a 20 megabyte hard disk in about 5 minutes. But practically speaking, once you back up your hard disk completely for the first time, you never need to do more than invoke the archive command—that convenient command that tells your new tape drive to back up everything since you last backed up. If you backup as often as you should, your Express Systems tape drive will finish the job virtually in seconds.

The Express Systems software has additional benefits, like enabling you to use PC DOS terminology such as "*", "*.*" and "?". It also has a built-in reformatter, built-in verification (to make sure you transferred what you thought you did), and it's prompt driven, which means it asks you exactly what you want to do.

Easy to install

Before you get intimidated about installing our tape drive internally, you should understand that IBM doesn't think it's too difficult. They're selling IBM PC ATs with instructions on how to add additional hard disks in the *Installation and Setup* manual that comes with the AT.

The IBM AT installation manual shows how easily you can install internal storage drives yourself.

Our instructions for installing your new Express Systems tape drive follow IBM's clear, simple instructions.

We even provide the tape cartridge

Most people don't realize that the tape cartridge contains most of the critical mechanisms to insure data integrity. In order to be sure that you get the best insurance for your data (after all, isn't that why you're buying it) we encourage you to use Express Systems' specially tested tape cartridges. We're not going to kid you and tell you others won't work, but here's what's special about Express Systems' tape cartridges.

First, they are tested down four separate tracks from end-to-end, not just down the center of the first 150 feet, like some others do. We use three screws to hold the cover on instead of four. This simple triangular arrangement keeps the baseplate flat, just like three legs work better than four to make a table steady. Since all tape drives reference everything to the baseplate, this alignment is critical. We also use special rollers to dissipate possible static electricity buildup—something that can ruin your whole day.

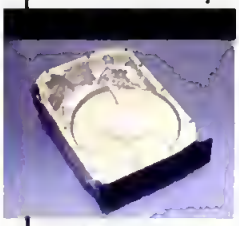
The Express Systems tape drives come with Express Certified™ 5.55 or 600 ¼-inch tape cartridges with quadruple end-to-end testing for extra insurance of your data.

And finally, we will sell you tape cartridges in boxes of three instead of the usual five. So, you get higher quality with a smaller quantity commitment. And we compound the savings with a lower per unit price, just $35.00 instead of the usual $45.00 most retailers charge.

Need a hard disk?

Depending on whether you have an IBM PC, XT, or AT you may want additional hard disk storage. We have those too. We offer 10, 21 and 31 megabytes of formatted hard disk storage.

For the most part, our drives are made with plated media, which means there is less chance to damage them. (Let's face it, the oxide that most disks come with is nothing more than rust.) We then test the drives, pre-format them, and install DOS 3.0 so that you're ready to begin transferring files. We even include DOS 3.0 documentation.



Express Systems offers 10, 21, and 31 megabytes of formatted storage in the half-high form so you have extra space for other storage options.

And they're 100 percent IBM compatible. The controller we send you for the XT is an upgraded version of the XT controller from the same company that makes the XT controller. In fact, the Express Systems controller is an improved controller which requires less power so that it is more reliable than any other standard controller.

We provide the power too.

If you want to upgrade your IBM PC, there just isn't any way around upgrading your power supply—if you want to have true XT or better capability. Some companies say that their hard disks don't require any increase in power—and they might be right. But don't add anything to your slots, because the minute you do, you'll need more power. That's the bad news.

Our 130 watt power will convert your PC to XT standards; and it's only $99.50 with any tape drive or hard disk order.

The good news is that our power supplies are inexpensive. How's $99.50 for an XT power supply? We mean a full 130 watts of power. The other good news is that it's held in by only 4 screws. Express Systems' power supplies can be changed in 20 minutes, a small price in time for the peace of mind to convert your PC to an XT-capable machine and avoid the unsightly "wart-like" power supply add-ons that some companies insist you paste on the back of your PC.

Express Systems Upgrade Kits

(Includes controller, software, and cable where appropriate)

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We get tired of the snide remarks some people make about mail order houses. The comments are usually spread by distributors and retailers who are getting cut out of 15 and 35 percent margins, respectively. If we went through distribution—you'd have the privilege of paying for large glass windows, rugs, salesmen, etc.—but we'd also be selling this tape drive for $1495.

We're not criticizing distributors and retailers. They perform a valuable service. But you don't need them if you know what you want. And you can certainly install it yourself. IBM has proved it with their instructions for self-installation that come with the new IBM PC AT.

And speaking of IBM, the next time you hear anyone criticize mail order as a way to buy computer equipment, remind them that IBM is now in the mail order business.

Warranty

We offer you a one year warranty on our hard disks—the same as IBM on the AT and 90 days on the tape drives. (It's all the manufacturer gives us.) If anything goes wrong with your tape or disk drive or hard disk, send it back in the box it came in. However, we have found that we can usually solve the problem over the phone. So call first for a return authorization number because we can't accept any returns without it.

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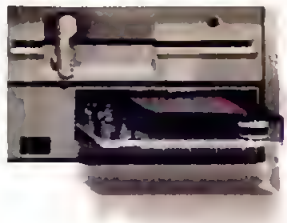

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What's Inside

Just as electronic keyboards have revolutionized the "feel" of the modern newsroom, so interactive voice systems may dramatically change the experience of working with computers.

Our readers may recall the old movies about newspaper reporters—starring actors like Cary Grant and Rosalind Russell and a horde of cigar-smoking, fast-talking gentlemen who always yelled, "Stop the presses!" These movies usually took place against a background cacophony of clacking typewriter keys going at about 75 mph.

As you may know, the manual typewriter has gone the way of the cigar-smoking reporter; both have been replaced by word processors in the one case and professionals in business suits in the other. Newspaper and magazine offices still have keyboards, but the sounds of electronic tapping are considerably muted.

At this point, the romantics sigh, "Oh, what a pity." And a few crusty old journalists yearn for the days when you had to shout to be heard. But among the younger writers and editors, it's a relief to be able to talk on the phone in a normal tone. (Consider, too, that most of us spent our youth destroying our hearing at rock concerts and, therefore, need all the help we can get.) For us, the quiet tapping of distant computer keyboards has an almost subconsciously soothing effect, rather like the Muzak piped into elevators (although a bit less intrusive).

This happy state of affairs may be

short-lived. Time and technology wait for no one, and a new group of voice-oriented microcomputer products has begun to hit the market.

Ears for the PC

Some computers, for example, are beginning to understand—or, at least, respond to—human speech. In this issue, John Schoen has examined several new hardware/software systems that give the PC a sense of hearing. Meanwhile, Dick Aarons has reviewed a group of voice synthesis packages that can store either sound patterns or whole words and enable computers to actually "talk."

PCs don't have to do the hearing and speaking themselves, however. They can also make it easier for their owners to verbalize. Glenn Hart has taken a look at several microprocessors devoted to telephoning. These handy little items let your computer dial the phone for you, let you know that a call is waiting, and let you simultaneously use the same communications line to send information and talk about it.

David Ritchie has written an article describing how such interactive systems allow sight-impaired people to use their microcomputers effectively. And Winn Rosch, not content with merely buying a voice synthesis system, actually built one—and described just how he did it.

Voice Mischief

Unfortunately, although it's nice to be able simply to tell your PC to copy files and pull down help menus, the accident potential is obvious. Suppose, for example, that you are sitting at your desk, minding your own business, and a coworker comes in to chat.

"I hear it's your daughter's birthday this week. Have you bought her a gift?"

"Not yet," you answer. "I haven't any idea what kids like these days."

"How about some winter clothes?"

"What a good idea!" you say. "You know, she said she'd really like a pair of furry boots."

(continued)

Photograph: Dennis Chalkin

(continued)

"Okay," pipes up your PC, "Rebooting." Your colleague escapes as you pound on your computer screaming, "No! No! I didn't save that file yet!"

Of course, technology has advantages and disadvantages as associate editor Barbara Krasnoff recently discovered a few days after she agreed to participate in a small interoffice experiment. Her computer, along with two others, was hooked up to a high-speed printer through a new buffer device. All seemed well, until Krasnoff walked in one Monday morning, turned on her computer, and discovered a hard disk error message on her screen.

After the initial moment of panic, she called in technical assistant Mike O'Cone, who has been known to work miracles. He listened to her story, sat down at the keyboard, and after several tense moments asked hesitantly, "Umm . . . you didn't have anything *important* on your hard disk, did you?"

That can crimp anyone's style, especially on a busy Monday morning. For the rest of the day, Barbara looked as if her pet shark had just died, and very few people dared the dark regions of her office. Even editor Bill Machrone poked his head in only briefly to say, "I've disconnected the buffer from your machine. . . . Hope you don't mind , . . ." and then disappeared.

Soon after that, Krasnoff decided that she needed to use her modem once more before she gave up her computer to the repair service. She poured herself a fifth cup of coffee, sat down, and glumly turned on the machine, intending to boot it off of the floppy disk drive.

Most readers familiar with the occasional fickleness of personal computers will have already guessed that the computer worked perfectly. Had the buffer caused her computer to experience deep emotional disconnection? Or was the hard disk on temporary strike?

Only the computer—and maybe Mike O'Cone—knows. ■

Some computers are beginning to respond to human speech.

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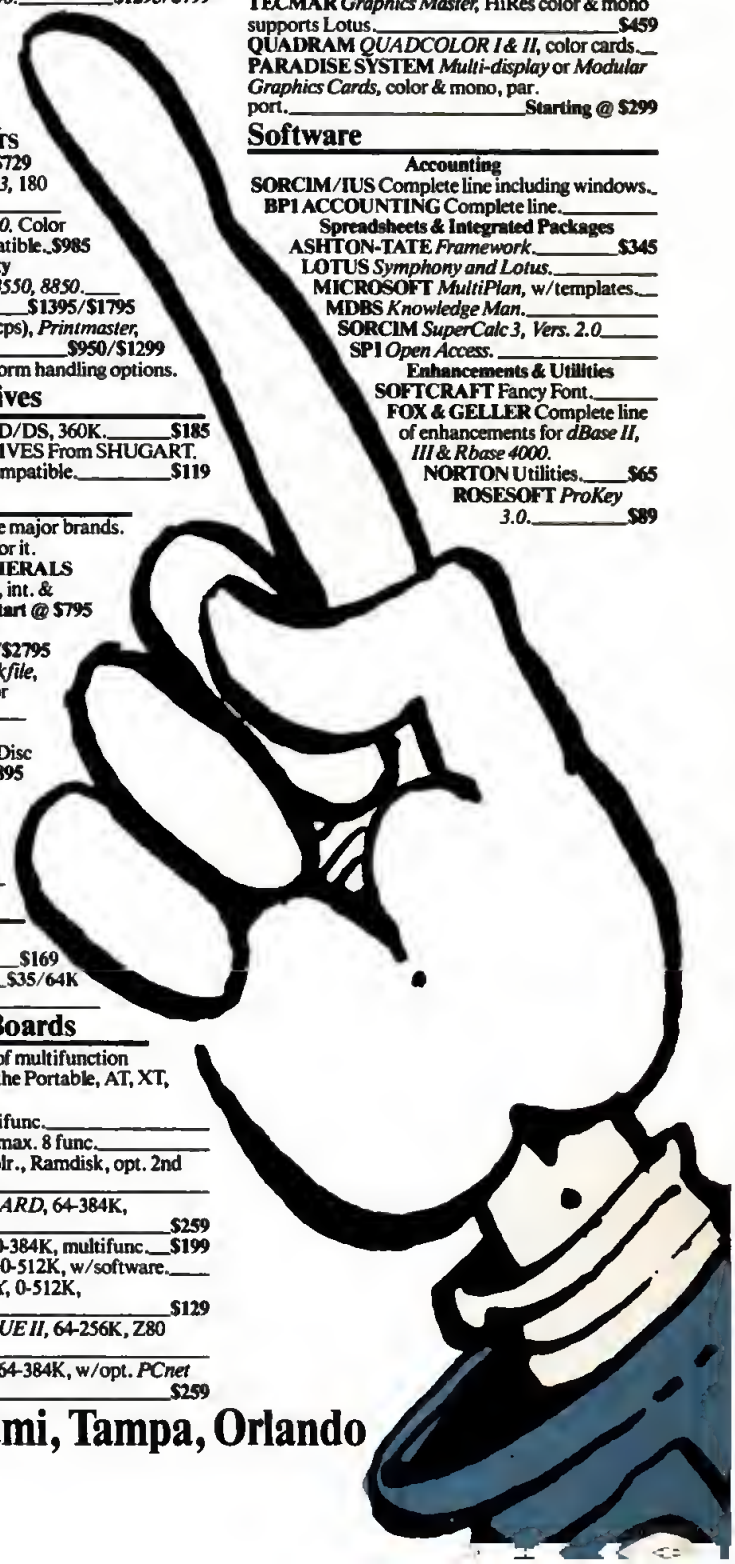

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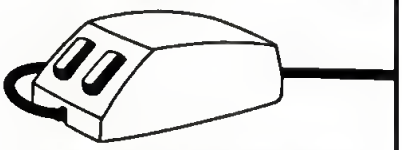

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*Planning Assistant available early 1985
**IBM Product Center prices.

ducks in a row.

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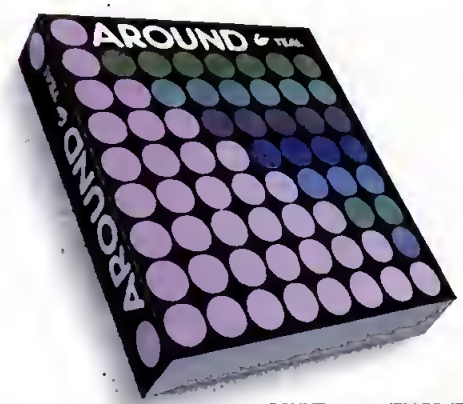

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IBM Personal Computer Trends and Developments

IH News

FROM THE EDITORS OF PC

MARCH 5, 1985

Industry Reactions Vary To AT Distribution Cuts

The rumor mill and third-party suppliers are both working overtime.

BY VIRGINIA DUDEK and CHARLES BERMANT

BOCA RATON, Fla.—IBM's announcement of delays in the availability of the enhanced PC AT has set the computer industry rumor mill spinning, with both IBM and the sole-source manufacturer of the AT's hard disks denying speculation about widespread mechanical failure.

IBM's official reason for the delay, announced in December, is a shortage of hard disk drives and other parts. This announcement was followed by talk of possible controller and operating system glitches, along with reports that a large percentage of the AT hard disks were "dead on arrival."

IBM spokesman John Pope was clearly annoyed at these reports, denying their accuracy and saying, "We have no reason to lie, but you can believe anything you want." He claimed no production cuts had been made and said only that dealers will not be getting as many systems as originally planned. He added that IBM had inspected warranty claims on a national basis and found no indication of a problem.

Irwin Rubin, chairman of Computer Memories Incorporated of Chatsworth, Calif., the sole source of AT hard disks, said that less than ten drives had been returned directly to CMI and that, as far as he knew, less than 300 of the 80,000 CMI drives shipped to IBM and other manufacturers had been returned nationwide. He categorically denied that the AT delays are caused by drive failures.

In order to accommodate demand brought about by the AT, CMI recently added a new manufacturing facility. It was also reported that IBM made a multimillion dollar loan to CMI. Rubin would neither confirm nor deny this, saying, "If I were making a supposition, I would say whoever made the loan did so because the drive is excellent."

The introduction of the AT last August has already caused a

(continued on page 34)

MSA Will Get It For You Wholesale

Major corporations are the targets of this volume and service-based operation

BY JOHN DICKINSON

SANTA MONICA, Calif.—MSA's microcomputer software may no longer grow on the Peachtree—or, at least, it may not do so for much longer—but that doesn't mean you won't be able to buy microwares from Management Sciences of America. At the same time that the Atlanta-based mainframe software company has been attempting to sell its Peachtree Software subsidiary, it has also started a Micro Distribution Division to bring discount retailing to America's corporate users in an organized, and very big, way.

Company officials say the new MSA division is a response to the abandonment of direct corporate marketing practices by many of the major microcomputer software companies, such as Lotus Development Corp. That, according to division senior vice-president Howard Smith, has left corporate buyers without an organized way to buy software and peripherals for their PCs. Their only choice is to use traditional retail and mail-order channels, leaving them, according to Smith, without adequate product guidance during the selling cycle and often without essential support after the purchase.

MSA claims its Micro Distribution Division eliminates these problems while also bringing substantial discounts and other benefits to corporate buyers. The division provides a wide variety of software and hardware products to corporate customers through a single-source distribution system. Software discounts range from 30 to 45 percent and hardware discounts from 20 to 35 percent depending on the client's annual

(continued on p. 35)

All the President's Words on New Service

The White House sidesteps the press for those who want their news directly.

BY JAMES LANGDELL

WASHINGTON, D.C.—Your PC might not help you fight city hall, but it now provides a direct line to the White House. You can read the President's speeches, executive orders, schedule, and other announcements on line through the White House News Service, on ITT's Dialcom network.

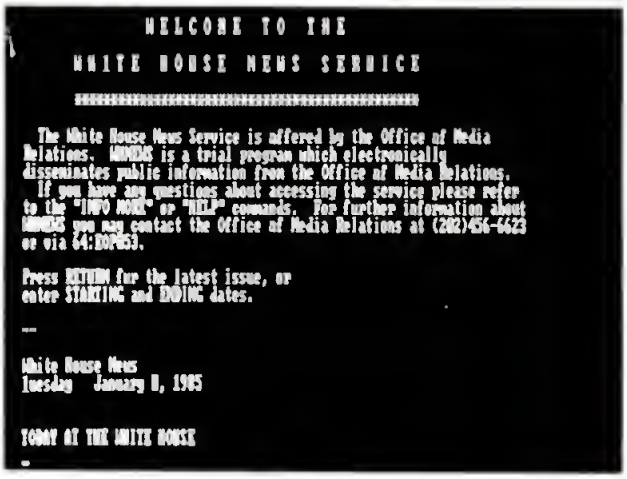
The White House News Service database contains the official, unedited versions of news handouts from the President's press office. It also provides full texts of Mr. Reagan's speeches and all news releases from First Lady Nancy Reagan, Vice-President Bush, and the Office of Management and Budget.

A White House response to Reagan's complaint that his views are distorted by the reporters who cover him, the White House News Service's purpose is to make Reagan's full, verbatim statements more accessible to the press and public outside of Washington.

Sample Fare

One day's issue included a list of Reagan's scheduled meetings, announcements of appointments to government positions, biographies of the appointees, and the full legal text of an executive order on the regulatory planning process.

The on-line service has operated on a trial basis since September 17, 1984. In the White House's Office of Media Relations, one person works full time to put the texts on line the same day they're distributed in printed form. All texts from the previous 2 weeks can be searched and read for $15 per hour above Dialcom's connect charges. The White House, however, receives no revenues from this service. Sue Mathis, acting director of the Office of Media Relations, does hope the service will save the costs of duplicating and mailing printed announcements.



While the service may achieve the administration's stated purpose, it could also make life easier for the Washington-based press. Reporters can avoid going through the Secret Service's Byzantine clearance procedure and instead access White House information without leaving their desks. Unfortunately, Dialcom offers access to only 2 weeks worth of files at a time, limiting its use as a research tool.

Other reporters see a darker side to the news service. "I call this an 'end run' around the White House press," says Joe Spear, an associate of columnist Jack Anderson and author of *Presidents and the Press: The Nixon Legacy*. He calls the on-line White House News Service "a more sophisticated extension of the packets sent by the White House's office of communications—in this and previous administrations — to editors around the country."

Spear feels the packets and other news fed directly from the White House has had a "significant but not outstanding" influence on the news media, "although the White House would say all it's doing is giving the context. When the editor of a medium-sized newspaper in Kansas sees a story sent to him on White House letterhead with his name on it, he's likely to be impressed."

Will the new on-line WHNEWS give the White House greater influence over the reporting of political news? Spear expects that once the novelty of the system wears off, access costs will discourage most users.

On Dialcom, the White House News Service is available through the Electronic Newswires menu under the name WHNEWS. For further information, contact the Administration's Office of Media Relations at (202) 456-6623. ■

Speaking of Computers: Exact Science?

"The standard measure of chip storage is the K, short for "kilo" ("chilo" is Greek for 1,000). In computerese it means 2^{10}, the power of two closest to 1,000. K = 1,024—almost Greek for almost 1,000!"

Larry Gonick, The Cartoon Guide to Computer Science

AT CUTS (continued from p. 33)

significant peripheral market. Manufacturers of AT-compatible hard disks saw the delay as fortuitous, hoping that consumers would buy the unenhanced AT and add on a third-party hard disk.

Growing Quickly

"We had planned this strategy for some time." says Willie Robinson of 1-2 Interface of Canoga Park, Calif., which manufactures AT-compatible disks holding from 21 to 117 megabytes. "The delay made us all the more happy."

Data Technology Corp. of Santa Clara, Calif., plans to milk the delay, but expects the demand for its product to continue after the shortage.

Steve Roberts, Data Technology's director of retail operations, said that his company markets higher-end storage components not offered by IBM. Data Technology is also supplied by CMI, although on a significantly smaller scale than IBM. Roberts said there had been no problems with CMI in either performance or supply.

One Source Surprise

Many of those contacted expressed surprise that IBM had only one source for the AT hard disk. To put all the disks in one basket seems a contradiction of the company's cautious image, but IBM's Pope would not say if a second vendor was being sought.

"I'm surprised that they had a sole source for such a key element as the hard disk," says Bob Stroh, vice-president of marketing for Mountain Computer in Scotts Valley, Calif. "It amazes me. It puts some retailers in a real bind, since they are depending on revenues from the AT to carry their operations."

Hard disk manufacturers are expected to take advantage of the delay, selling add-on drives until more enhanced ATs are available later this year. But Bob Hagen of Entre Computer Systems in Tucson, Ariz., said that his company was not offering such systems because "most people will choose to wait for their AT rather than buy a unit without a full IBM warranty." ■

MSA *(continued)*

buying commitment.

According to MSA press official Helen Taffet, "There is no connection" between the new distribution division and MSA's sale of its Peachtree Software subsidiary. "Peachtree just didn't fit in at MSA and wasn't making money," she says.

Wide Variety

The Micro Distribution Division's product sheet packs an impressive array of products from traditional vendors, such as Ashton-Tate, Micropro, and Lotus, as well as from newcomers such as Borland International and Consumers Software. The portfolio includes Peachtree but makes no mention of any IBM products. The division doesn't even sell PC-compatible computers. When asked why, Smith quipped, "We learned in the mainframe business that you don't step on Superman's cape."

Even without IBM, MSA's product list covers 23 single-spaced pages and contains more products than most normal retailers could ever afford to carry in inventory. MSA offers the "down-the-street convenience" of traditional retailers by offering clients free overnight delivery of any product.

Free Advice

MSA offers free prepurchase consulting to any established customer, both on products it distributes and on those it doesn't. MSA claims expertise in topics ranging from entry-level word processors to micro-to-mainframe connection products and offers its services on-site or via telephone. Officials at the company say it is able to offer consultation on products it doesn't carry because its continuing product-evaluation research keeps it up-to-date on the entire range of offerings in the microcomputer industry.

As an added bonus, evaluation copies of software products are available to clients on a 30-day trial basis. Once the product is purchased, training is available both on-site and at MSA training centers.

MSA provides continuing telephone support, and Smith claims that it can provide response time superior to the original vendors' because of its lower customer load and because it has better information on what each user is doing with the product and what other products are being used along with it.

Howard Smith

MSA also claims that its volume purchase of products enables the division to get better response from the original vendors to the really tough questions (the ones that usually take 2 or 3 weeks to answer) and to product bugs.

Fringe Benefits

MSA's inventory trade-in policy is an unusual benefit for its corporate customers. Any unopened software product can be traded in for credit against any future purchases. This policy is designed to help corporate clients establish in-house "computer outlets" for their users and allows them to get rid of items that aren't moving.

Another sales tool used by MSA is a Talking Demonstration Software machine that features a PC hooked up to a voice synthesizer. The prospective buyer inserts a demo disk into the machine, which then talks its way through the product, showing the user the software's features graphically and vocally. Workshops, which are really sales seminars, are held quarterly in major cities. These seminars include a presentation of or training for a new software product being promoted by MSA.

Commitment

At a recent MSA workshop in New York, Lightyear Inc. presented and demonstrated its new executive management system for about 35 customers, prospective customers, and members of the press—although the bulk of the time was spent explaining MSA's new division. MSA gave out versions of *Lightyear* so users could become more familiar with it back at the office.

What's the catch? Well, to become an MSA Micro Distribution customer, you have to commit your company to annual purchases of $100,000, with a minimum order of $10,000. That'll get you a 30 percent (the minimum) discount on software. To get the maximum 45 percent discount, you have to ring up $500,000 per year at MSA.

That's actually not too bad if you're a major corporation and want to or are willing to buy all your software through one source. If your company is not in the Fortune 1000 category, however, it looks like MSA's services and discounts are just more examples of big companies' getting all the breaks.

MSA's Micro Distribution Division is located at 1321 Seventh St. # 201, Santa Monica, CA 90401, (213) 395-7860. ■

Tallgrass Replaces Line

OVERLAND PARK, Kans.—Tallgrass Technologies, a manufacturer of mass storage systems and tape backup units, is replacing its entire product line in March because the systems are no longer state of the art, according to a company spokesperson. Current models are effectively being discontinued, and a new tape format is being introduced along with the new line.

Four new mass storage systems will be marketed, the largest being an 80-megabyte disk with an installed 60-megabyte tape backup selling for $7,495. PC/T, the new format developed by Tallgrass and supported by Hewlett-Packard and 3M, does not fragment files; it features overwrite and record updating capabilities. Tallgrass also hopes to add the ability to access programs from tape.

"With prices of microcomputers coming down so quickly, tape will have to provide more than streaming backup to justify itself," says Steve Volk, vice-president for sales and marketing. "I believe we are now presenting tape in a new light." Volk claims that the new tape format is capable of correcting up to 4 kilobytes of lost data.

Tallgrass will continue to support its installed base, which Volk estimated at 40,000 units. All warranties will be honored, and the company will continue to produce small quantities of the current products.

—Charles Bermant

Tandy Takes Its Time—and Yours

We realized it was going to be a long day when we tried starting up Tandy's new XT clone, the Model 1200 HD. While running the hard disk initialization routine, this message appeared: "Formatting fixed disk C: allow 1 hour for completion."

An hour! The IBM PC-XT's hard disk only takes about 5 minutes. Tandy, fortunately, fell short of its promise: The disk was ready in 35 minutes.

Some programs, before launching into a lengthy process, have a genial on-screen message that invites you to go have a cup of coffee for a few minutes. Here, Tandy might suggest, "While the fixed disk is formatting, why don't you go bake some potatoes?"

—James Langdell

PC BRAND™'s CRAFTSMAN™ TOOLS FOR C PROFESSIONALS

LIBRARIES: *Hundreds of Functions for Fast Programming*

C is a bare-bones language. It does not have built-in (machine dependent) functions for printing or floating point math or string manipulation. That's why it's so portable. That's also why libraries of pre-written functions are such big sellers: bullet-proof routines your application can effortlessly call to get the job done.

GREENLEAF FUNCTIONS

More than 200 functions in C and/or assembler source, and a 200 page manual with examples and demos.

32 DOS extensions: file and directory manipulation for DOS 1.1 and 2.0

23 Screen Functions: Select mode, page, monochrome or color, palette, cursor shape, positioning, clearing and scrolling, character reading and writing with attribute and color control, pixel get and put, read light pen.

60 String Functions: Manipulation of strings including center and justify, efficient list operations which add, delete, and sort pointers to strings for top speed.

50 Graphics Functions: Primitives to access all graphics; typeface, formatting, and forms control for IBM Graphics Printer.

Plus keyboard status and function key assignment, time and date algorithms ... we could go on!

Product Code S0770 # Our Price
List Price **$175.00** **$140.00**

GREENLEAF COMMUNICATIONS *NEW!*

Want your application to communicate with other users or remote date bases? Now you can build asynchronous communications right into your C programs!

Over 60 functions set up an interrupt driven scheme with separate transmit and receive ring buffers (characters are simultaneously loaded at one end and transmitted from the other, or vice versa) for an arbitrary number of ports. Interrupt control means you can download a record, then halt the incoming stream to file it, display it, let the user tamper with it, send it back up line. It all happens within the context of *your* program, using your user commands, and does away with the sidestep to the separate communications software (and its semantics) you had to use until now.

The Greenleaf Comm Library supports ASCII or binary, any parity, any word length, 8250 UARTs, all four Lattice C memory models, Hayes 300, 1200, 1200B and other modems.

Its 80-page manual has examples of each function, discusses asynchronous communications, and both the library and demo programs come with source (a mix of C and assembler)!

Product Code S0750 # Our Price
List Price **$160.00** **$130.00**

LATTICE C-FOOD SMORGASBORD

Decimal Arithmetic: Trigonometric, logarithmic functions, powers, conversion to strings, BCD operations for numbers up to 16 significant digits.

Level 0 I/O Functions: Direct operations for screen, keyboard, printer, and asynch port with no dependence on higher level I/O will minimize memory usage and maximize speed.

IBM PC BIOS Interface Access: Gets basic I/O services in ROM BIOS not available from the operating system to get and set video mode, cursor position, color and screen attributes, keyboard shift, scrolling, printer channel, port status.

Terminal Independence Package lets you move programs to computers with other types of terminals.

Product Code S0200 # Our Price
List Price **$150.00** **$115.00**

Quite a treasure. So cost effective that after using only a couple of functions you'll be saving a bundle compared to writing your own. (It's true; how much do you cost per day?) So why not go for the whole bundle!

HALO

A Spectacular Graphics Extension to Lattice C

Halo™ will astound you. It provides a complete library of graphic functions which can be linked with your Lattice programs to create full-color charts, graphs, simulations, even animation.

Over 100 commands are at your disposal, including plot, line, arc, box, circle, plus single commands to produce bar graphs and pie charts. Pattern-fill and dithering commands give your graphics impressive texture and color mixes, rubber-banding draws shapes for interactive users, area moves produce animation, fill and flood commands paint areas. The newest version allows you to define your own world coordinate scheme, divide the screen into "viewports" (windows), and scale graphic figures automatically.

It's a long list of capabilities which make for an extraordinarily powerful product. In fact, Halo is so good that manufacturers of graphics boards and systems are adopting it as a standard graphics language. So it can bridge your application to other systems. CAD-CAM developers, especially, have embraced its device-independent approach for maximal portability. Halo offers a dazzling demonstration that function library architecture will tremendously enhance your firepower.

You'll need an IBM monochrome or color graphics board for our standard version, but other versions now support ten boards and their equivalents. Halo is sold in a one board, one language configuration (special pricing for multiples), but each version now comes with a multitude of I/O drivers for mice and printers.

Tip: Ask us to throw in Dr. Halo for an extra $95. It's a "paint" program written with Halo, far surpasses other pretenders, and will open up realms of creativity. Brilliant beyond belief.

Product Code S0600 # Our Price
List Price **$225.00** **$175.00**

Product Code S0300 Our Price
List Price **$200.00** **$125.00**

PMATE

The Programmer's Word Processor

Pmate™ was designed for programmers. We'll wager that you cannot find a programmer who has discovered Pmate and moved on to something else.

Pmate is a full screen editor with ten auxiliary buffers for squirreling away pieces of text until needed. It uses single key commands to move the cursor, or text, or insert or delete, or rescue several thousand characters of deleted text.

It has a format mode for tab setting or wraparound and shaping when it's time to write documentation. Pmate lets you assign chains of commands or strings of text to single keys: a keystroke could set up the entire shell of a new C function, for example.

Pmate has variables, if-then statements, loops. It calculates, and converts decimal to hex to binary and back. You can write compact programs (called "macros") to delete comments, for example, or check syntax, or process long sequences of commands. Macros can alphabetize lists, do row and column math, perform a series of operations on multiple files, even summon other macros.

Put another way, Pmate is a text editor with its own built-in interpretive language. A language you can use to completely customize this text editor to your fancy. Possibly the most artful, ingenious program you have ever seen.

Product Code S0350 # Our Price
List Price **$175.00** **$145.00**

BASIC_C

Use Your Knowledge of BASIC to Learn C

If you're getting the message that switching from BASIC to C would be prudent, you're about to discover that it's back to basics of a different sort. BASIC is fat with hidden functions that stripped down C just doesn't have.

Gone are all those handy string manipulators like LEFT$, MID$, STRING$, etc. (although our library offerings add them back). In C, when you reach for even simple invocations like INPUT or PRINT A$,X% — well, sorry to disappoint, but underlying such expressions in BASIC are bulging macros which C cannot have if it is to keep its slim profile.

But now comes BASIC_C and all your old favorites are back. Someone has written the full set of C functions to mimic BASIC's vocabulary, from ABS to WRITE. Over 80 routines to open and close files, "field" file buffers, convert their contents from and to strings (the CV? and MK? series), peek and poke, print using, clear screen, "instr", on error goto ... they're all there. Some have reworked names and syntax to suit C, but all are written as one-to-one functional equivalents to the familiar features of BASIC. And they are documented one to a page in alphabetical sequence like the Microsoft manual for added familiarity.

So with BASIC_C, when you're thinking INPUT, go ahead. Use it. Or LPRINT or LOCATE or INKEY. But without BASIC_C, you will find that every line of code plunges you back in the C texts to figure out how to write it. Someday you'll want to, but for now, BASIC_C will start you programming quickly at the statement level so that you can concentrate on C's larger concepts.

There's a bonus: an unusually well-written manual with a first rate chapter comparing how BASIC and C go about their tasks. Without question, BASIC_C will ease your transition to C.

LATTICE WINDOW

All Your Applications Could Have Windows!

Windows are no gimmick. Ask any user of a windowed product.

But how do you add this technique to your applications without disappearing for several months of R&D?

With Lattice Window,™ that's how. One of those rare programming tools which will change the way you think of program design. Here's how.

Lattice Window takes over all screen management. It is an extensive set of object code functions which you merely call from your C program.

Think of a window as a screen of flexible size. You can tell Lattice Window to open and close many such virtual screens. Up to 255 at a time, each from 1x1 to 255x255 bytes. Then tell "Window" to display any portion of these virtual screens on the physical screen — as many as fit. Tell "Window" to place them wherever you want, overlapping and overlaying at will.

Windows no longer needed may be closed. Any background area overlaid earlier (which could be corners of several windows) will pop back to the screen. Think for a moment what a programming job that technique represents.

To your program, the entered window is the *entire* screen — all row and column references are relative to the window no matter its absolute position in the screen. All scrolling occurs only within the active window. The cursor will not leave its boundaries until your program says to. Any screen window may be entered for display, data entry, whatever. *Any* virtual screen — displayed or not — may be read from or written to by your program.

- You can move a window on the screen.
- You can grow it to display more of the underlying virtual screen. Or shrink it to show less.
- You can control screen attributes (color, blinking, inverse video, etc.) of any window.
- You can direct output to either the monochrome or color board.

It's a formidable product which will add incomparable flair to your next application!

Product Code S0800 # Our Price
List Price **$295.00** **$235.00**

FAST-C

This Editor Finds Compile Errors

Here's how to speed up the glacial crawl of editing your program file, running the compiler, noting errors, counting lines to find them, reloading the editor, and around again.

Re-direct Lattice C's error messages to FAST-C (via pipe or file). FAST-C puts errors and program together on the screen and gets you out of the line counting profession. It shows each error message in turn, highlights the program line which caused it, and displays the ten lines above it. FAST-C is an editor, so you can fix the error on the spot, then move on to the next, or access your entire program, add new code, etc.

You also get a library of handy debugging functions which display values, let you modify them, show contents beginning at a specified address in both hex and characters, and signal whereabouts in the program. And a multi-file scanner which can find or search and replace, using wildcards, up to 100 files at one go.

Product Code S0250# Our Price
List Price **$129.95** **$105.00**

TO C OR NOT TO C IS NO LONGER THE QUESTION

BTRIEVE
Is a Pro Like You Still Doing the Filing?

If your programming still gets anywhere near the files, here's our guarantee: Nothing will increase your productivity faster than handing the filing job to a sophisticated file manager.

Btrieve™ is the best we have seen. It takes complete charge of all file indexing, reading, writing, insertion and deletion. It builds 22 commands right into the language you use in the form of functions you call to tell Btrieve what to do. The commands create, open, and close files; delete and insert records, recapturing vacated space; find records which exactly or most nearly match keys; walk files by ascending or descending key.

Btrieve's foundation is a balanced-tree indexing scheme, conceded to be the fastest search technique devised (it will find any key in a million-plus item index in four or less accesses).

Btrieve comes with interfaces to C, Pascal, BASIC, and COBOL, and the manual gives you working sample programs which demonstrate every command in all four languages. The kind of presentation which led *PC World* to exclaim "for those of us who have endured poorly written and inadequate manuals, this one is a pleasure to read."

Btrieve has mainframe specifications! A single file may have up to 24 indexes. Segments of keys may be indexed. Each index can independently accept or block duplicate keys. A record length can be up to 4090 characters; an index length 255 characters. A file may be 4 billion bytes. It can even extend a file across two drives — even two hard disks!

With Btrieve you are freed to think logically; the physical file is no longer of concern. Gone for good is all that time-wasting dickering with intricate file referencing schemes and sorting algorithms. Thinking shifts to a higher plane.

Product Code S0650 Our Price
List Price **$245.00** **$199.00**

PANEL
You've Hand-Coded Your Last Data Entry Screen

Designing custom screens is intricate, time-consuming, and costly. It can make you the loser in competitive bidding. It can add weeks, even months to bringing your product to market.

But not when you use Panel™. Put Panel to work and you hire a superprogrammer for the minimum wage. Telling Panel your screen design is like using a word processor. You can add, move, copy, delete, and reshape fields with single key commands. The result? Finished C source code with field descriptors, color and highlighting, input editing by type of field, help keys, and warning messages.

Panel can also create a terminal selection program customized for your application, and gives you a utility to quickly test your finished screens. It supports user-written input verification code. It even includes a multi-key data file maintenance program which interacts with the screen you design. All the tools you need to generate code for the trickier aspects of your application.

Panel routines are powerful. Unlike so many programs which make error correction difficult once a field is departed, Panel gives the user full field-to-field movement for editing, and overtype or insert/delete within fields.

A truly superior productivity tool every developer should have.

Product Code S0400 #* Our Price
List Price **$295.00** **$235.00**

*except "Tailor"

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PLINK86
Size Unlimited with This Overlay Linker

Software is becoming ever more sophisticated, which means more complex programs requiring large chunks of memory. But if you use extra memory, you count on users to have expanded RAM, and forego sales to those who do not.

Plink86™ is the answer. It shoe-horns large programs into small memory. First, Plink86 acts as an alternative to DOS' Link. C encourages design of separately compiled object modules in the Microsoft relocatable format. Plink86 pulls modules together into single compiled programs. But Plink86's overlay power is what has gained it a reputation as a miracle worker. It binds into the compiled program its overlay manager which knows how to swap modules of your large linked program between disk and memory, so that each can temporarily occupy the same memory space.

Unlike other linkers, the overlay manager acts on its own, needing no calls from the source program. Instead, Plink-86's straightforward overlay description language allows you to describe your overlay structure in one place in your program — a structure permitting up to 4,095 overlays stacked 32 deep. No re-compiling to re-arrange the structure!

Plink86 can even sub-divide its linked output into multiple files for programs which must span more than one disk. And it produces a symbol map for debugging with Pfix86 Plus.

PC Tech Journal calls it "the premier linker and overlay loader that's taking over at many of the programming shops around the country."

Product Code S0500 # Our Price
List Price **$395.00** **$315.00**

LATTICE C
The Pre-eminent 16-bit C Compiler

C's structured approach encourages development of tight, fail-safe functions which can be counted on to return reliable results every time. Its local variables are unknown outside of functions which safeguard against accidents elsewhere. C offers powerful nested expressions which produce elegant, concise code. That's why C has become the language of choice among professionals.

Lattice C™ is the Number One C compiler. Peter Norton in *PC Magazine* (1/8/85) says, "best for systems programming, tight code, total control of what's going on, noticeably better than any of its competitors." After reviewing nine compilers for the PC, the *PC Tech Journal* unequivocally declared Lattice C "best for software development... it compiles fast and produces fast programs".

Lattice C runs on virtually any computer using an 8088 or 8086 chip, and generates code which optimizes use of the 8087 chip, if present. Create your source files with any word processor or text editor like our Pmate or ES/P for C and Lattice C will compile them into Intel 8086 object module format for linking to other modules by DOS's Link or our Plink86.

Lattice C offers a choice of four memory models between 64K and RAM capacity for program and data to allow the program designer to choose the right combination of small memory efficiency and large memory addressability for an application.

Lattice C is a full implementation of Kernighan and Ritchie (K&R), not a subset, with some extra features, eg., variable names up to 39 characters, and nested comments.

The compiler comes with a library of I/O routines which implement under MS™-DOS most of the Unix-compatible standards described by K&R, and then goes beyond. It has a fulsome set of transcendental and Unix math functions K&R didn't think to mention, and some of Unix's most useful options such as "fork", which can pull a second program into memory without disturbing the first, branch to it, and return.

Product Code S0100 # Our Price
List Price **$500.00** **$CALL**

RUN/C
REVOLUTIONARY!
A C Interpreter at Last — And it Works like BASIC!

C is contemplative, elegant. But even elitists yearn (silently) for the simpler days of throwing together code with the instant interaction of an interpreter.

The good old days are here again. We have not just a C interpreter, but one that acts like BASIC! Use RUN/C's in-line editor to create a program. RUN it, just like BASIC. If it stumbles, just LIST it, EDIT it, add lines, delete lines, RUN it again, fix it again. The simple luxury of break key interrupt is restored, and RUN/C™ even has TRON, TRACE, and a profiler which reports the number of times each program line is executed.

RUN/C's "editor" command will save a program and automatically hand it to your favorite editor for further work. Or you can use its "shell" command to summon your compiler from *within* RUN/C.

For the professional, RUN/C is ideal for rapid program development. Put up code at high speed, tinker and re-arrange, throw in test printouts, bang away at tight little sections until they're bullet proof — *then* hand them to the compiler.

RUN/C has a treasury of functions built into the interpreter — over 100 paralleling the most used functions found in Lattice C's library. Their interface is the same, so if RUN/C can run it, Lattice can compile it. Only programs calling other functions or other libraries for which you do not have source need special measures (eg., comment-out, dummy functions). Well worth it to win the productivity gains of an interpreter.

Your disk supplies a separate source code file demonstrating each of RUN/C's library functions, with a manual to match. In fact, if you are new to C, this product doubles as a superb tutorial! (Requires 256K, DOS 2.x)

Product Code S0900 # Our Price
$150.00

PFIX86
Advanced Dynamic and Symbolic Debuggers

Debugging programs without special tools is like fixing an automobile without lifting the hood. Pfix86™ lets you see inside your program while it is running; multiple windows show program code and data, breakpoint settings, and current register and stack contents simultaneously. You can make changes just move the cursor into a window and type. It has an in-line assembler, so you can enter program modifications in assembler at run time.

Pfix86 Plus is an enhanced version for use with modules linked by Plink86, even those with overlays. It retains the program "symbols" otherwise lost during compiling — the names you gave to variables, functions, etc. in your source code — so you don't have to deal with hex addresses.

Both versions have dynamic trace and breakpoint setting facilities. You can then disable them without removal, activate them only upon their nth encounter, halt them when a condition is met. Everything you would want in a debugger.

List Price Code Our Price
Pfix86 S0550 #~~$195.00~~ **$155.00**
* Plus S0555 #~~$395.00~~ **$315.00**

TERMS AND CONDITIONS OF SALE

Licenses: Each price is for a license to use a product on a single computer and does not constitute product ownership. Products coded "#" may be used to create programs for distribution without royalty payments or additional licenses, provided said programs do not substantially replicate the products themselves.

Compatibility: PC BRAND's standard products are designed to operate with the IBM PC, XT or AT under PC-DOS and require no more than 128K of RAM unless indicated.

Returns: Products returned will be accepted for refund or credit only by prior authorization subject to a re-stocking charge. Software diskettes are delivered in sealed envelopes and are unreturnable if seal is broken. Defective products will be replaced in whole or part.

Payment: We honor MasterCard & Visa (no surcharge), checks in advance, COD for cash or certified check, and funds wired to Chemical Bank, 126 East 86 St., New York, Account: 034-016058. Purchase orders accepted from corporations and institutions at our discretion, 2% per month added to balances unpaid after 30 days.

Shipping & Handling: U.S.: UPS Surface: 1st product $6, each add'l $2.50. UPS 2nd Day Air: 1st product $10, each add'l $4.50. UPS Next Day Air or Federal Express: 1st product $18, each add'l $6. Non U.S.: $15 per order for export/import forms, variable shipping charge.

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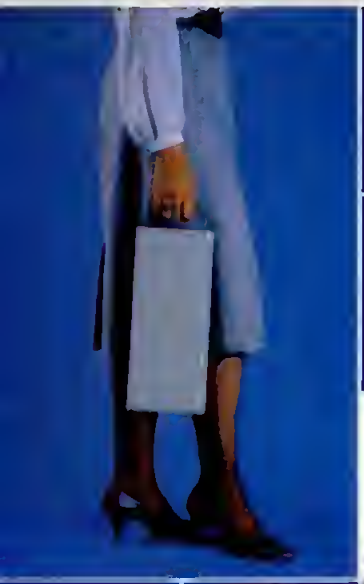
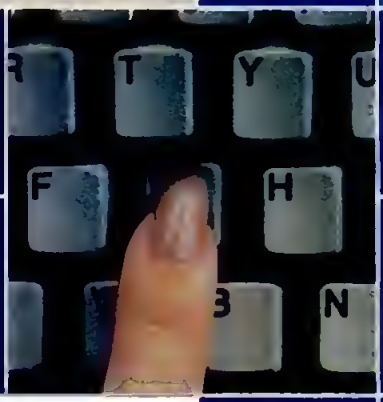
T4

Portable Backup!

Back Up All the Hard Drives in Your Office.

The MaynStream offers fully portable hard drive backup employing the latest software technology. It is compatible with IBM, Compaq, and NCR personal computers* and comes with an industry-leading 1-year warranty.





MAYNSTREAM

TAPE BACKUP SYSTEM
BY MAYNARD ELECTRONICS

Maynard Electronics

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305/331-6402

CIRCLE 437 ON READER SERVICE CARD

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News in Brief

Enrollment Limitations... If you were considering attending the **University of Texas at Austin's Department of Electrical and Computer Engineering,** you can forget it. At least until the summer of 1985.

Peter T. Flawn, president of UT, has had to limit the number of undergraduates who wish to enroll in the very popular department because the school does not have sufficient faculty, facilities, and budgets to meet the demands of the high number of qualified applicants.

Peter T. Flawn

The embargo is not permanent, however. Beginning in the summer of 1985, 700 new students a year will have a chance to obtain an electrical engineering or computer engineering degree at the university.

Speaking of Software Protection... Ashton-Tate is also rethinking its software protection strategy. An updated version of *Framework* (Version 1.1) will include a **new copy-protection system** designed by Softguard Systems.

The new version of *Framework* is easy to install onto a hard disk and will not require a "key disk" each time you load the software from a hard disk.

If you received your copy of *Framework* after December 1, 1984, you can receive a complimentary update by sending your license agreement to Ashton-Tate, 10150 West Jefferson Blvd., Culver City, CA 90230, (213) 204-5570.

Problems? Just Call... Sometimes the manuals don't have all the answers, so where do you turn to when you're in a bind with your new PC? Your dealer? The manufacturer? Your friends? Now, help is just a phone call away with a **hardware diagnostic service from 3M's Equipment Service and Support Division.** This new service is being distributed to PC dealers by the **American Guarantee Service Company.**

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The 3M Diagnostic Center is open 24 hours a day to handle problems such as printer malfunctions, disk or cassette errors, defective modems, and display terminal problems. The center will maintain a database of its customers and a service history of each of their computers.

For more information on the diagnostic service, contact Jerry Klein at American Guarantee Service Company, 6 Pinehurst La., Newport Beach, CA 92660, (714) 760-1980, or by MCI Mail, JKlein, American Guarantee.

Without the Protection... With user-convenience in mind, **The Software Group** now offers a **non-copy-protected** version of its popular integrated software system, *Enable*.

Users of the non-copy-protected version of *Enable* must agree not to violate The Software Group's copyright by signing a short form available by calling (800) 932-0233—(800) 338-4646 in N.Y. Users must also subscribe to a $95-a-year update program, which includes three annual upgrades, a newsletter, and a series of hints and tips on using the system.

Through March 31, 1985, if you bring a proof of purchase for *1-2-3*, *Symphony*, or *dBASE II* to your dealer, you can get *Enable* for $395 instead of the regular price of $695.

In addition, to help with marketing and sales strategies, business goals, and product pricing, The Software Group has formed a dealer advisory council. The group consists of leaders in the dealer and retail distribution sector, including Lou Wilhelm of ComputerLand and Donald Tobin from Entre Computer Center. A customer advisory board made up of *Enable* end-users is also being formed to help with the testing and development of software products.

The Software Group is located at Northway Ten Executive Park, Ballston Lake, NY 12019, (518) 877-8600.

BIOS for the XT...ROM BIOS software for **XT–compatibles** is being offered by **Phoenix Software Associates Ltd.** The systems-software compatible package will also include a PC–XT DOS–compatible version of MS–DOS, a range of utilities, and GWBASIC.

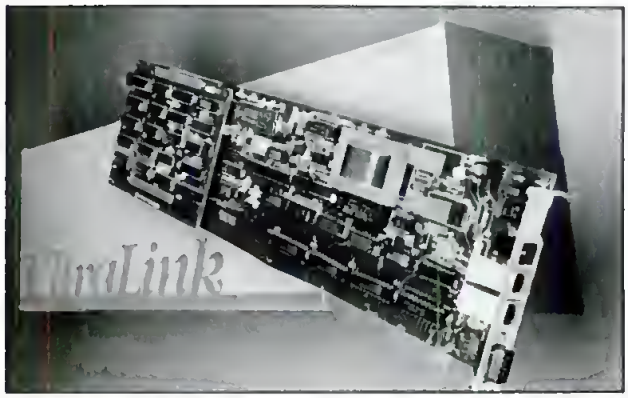
Neil J. Colvin, president of Phoenix, expects to license the software to OEMs that do not want to develop their own compatible ROM BIOS. OEM licensees will have unlimited use of the entire package for $290,000.

Phoenix will continue to offer its PC–compatible ROM BIOS and is developing a version of AT–compatible ROM BIOS.

Further information can be obtained from Phoenix at 1420 Providence Hwy., Suite 101, Norwood, MA 02062, (617) 769-7020.

PC-Telephone Linking...Modern Technology International, Inc. (ModTech), has introduced **UltraLink**, a PC plug-in board that will link your personal computer and your telephone.

UltraLink combines voice and data communications on a single, standard AT&T phone line, making sending data from one office to another quick and easy. The product, which includes on-board RAM and its own power supply, can also communicate with non-UltraLink modems.



More information on ModTech's $895 UltraLink can be obtained from ModTech, 656 Bair Island Rd., Suite 302, Redwood City, CA 94063, (415) 367-6855.

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CIRCLE 125 ON READER SERVICE CARD

PRODUCT REVIEW

Morgan Computing's BASIC Differences

Professional BASIC is an alternative to the language IBM speaks.

BY JOHN M. WORAM

Editar's Note: IBM Persanal Camputer BASIC, the language tucked away inside IBM's micracomputer family, is developing a grab bag of new dialects. Since Micrasaft BASIC's introductian, several new versions of the BASIC language have been released far the PC. We will look at many of them, in this and future issues ta give you a hand in deciding whether ta switch from your machine's plain vanilla and try a new flavor. Here's the scoop on Morgan Computer Compony's Professional BASIC.

Morgan Computing Company's *Professional BASIC* is a big program, taking up 195,328 bytes in the 2.01 version. In an earlier 2.0 version, system requirements specified a minimum 256K of RAM, but this is now increased to 320K (448K preferred). Previously, some 48 (IBM PC) BASIC commands and statements were not yet implemented, but the 2.01 update fills in 19 of these.

Memory requirements may climb even higher, as later updates add the 29 commands and statements that are not yet supported. For example, BLOAD, BSAVE, CALL, USR and assorted graphics statements (DRAW, VIEW, WINDOW, and so on) are still among the missing.

In addition to the size of Morgan *BASIC* itself, the program sets aside additional memory for its own use, as I quickly discovered on my 320K PC: With *Professional BASIC* installed, I have just 20,640 bytes left for my own. And it's easy to go through those in no time at all. For example, a one-line program 100 PRINT 3 occupies 14 bytes as an ASCII file, and loads into 12 bytes in the Microsoft BASIC work area. In *Professional BASIC*, it gobbles up 70 bytes of my precious 20,640. The manual explains that loaded programs expand (you're telling me!) because of extensive "seeding" operations, a sophisticated dynamic syntax checking system, integer storage (4 bytes instead of 2), and so on. When I tried loading a 9,036-byte program, there just wasn't enough room for it. I resaved the part that did get loaded and then took a look at it: it was 5,609 bytes long.

Basic Differences

Assuming you have enough available memory to do the program justice, *Professional BASIC* has lots of good—and some not so good—features to distinguish it from good old PC BASIC.

Morgan's use of two screens is interesting. As you enter or edit your program listing, the Command Screen is active. By the way, the program listing flies across the Command Screen in a fraction of the time it takes under PC BASIC. And you can come to a screeching halt just by pressing the space bar. Pressing it again advances the listing one line at a time. To resume normal operation, just press the Enter key.

When a program runs for the first time, there is a delay while it is "semi-compiled"—a process that is not explained in the manual, except to say that it speeds up program execution. Then the CRT clears, and the Print Screen displays the results of your program. Pressing the Scroll Lock/Break key suspends program execution, and the Command Screen displays the program listing with the current line number at the top. When you press Enter, program execution resumes, and the Print Screen is again displayed. Or you can press Alt-P and toggle back and forth between your program listing and the frozen display on the Print Screen. When the program finishes executing, the Print Screen disappears and the Command Screen returns—a bit unsettling, but you can return to the Print Screen simply by pressing Alt-P.

Screen toggling can be a very handy debugging tool: When the display runs amok, just suspend operation and take a look at where you are in the program. Then pick up where you left off and go on to the next trouble spot. However, when you do this, the background color (if any) goes black.

Split Screens

I have a few programs that make use of two monitors: User inputs, calculations, and text summaries appear on the green screen, while they draw graphs on the color monitor. For some reason or other, I couldn't get *Professianal BASIC* to bounce back and forth between monitors during program execution. The manual didn't help much, and the words *color* and *graphics* don't even appear in the index. In fact, the only way I could swap screens was to go back to DOS and use the MODE command. There should be a better way, but I wasn't able to find it.

Getting back to execution speed, the manual states that *Professianal BASIC* is generally much faster than PC BASIC. I tried to verify this by loading the included GRAPHICS demo program, which takes about 25 seconds to display a series of circles, ellipses, and other patterns on the screen. Then I tried the same program under PC BASIC and got a bunch of syntax errors—the result of an incompatible *Professianal* feature that lets you write such things as:

```
 60 GOSUB WHATEVER
400 WHATEVER; 'subroutine begins here
500 RETURN;
```

Later on, type LIST WHATEVER, hit the Enter key, and the WHATEVER subroutine will immediately be found and displayed. Neat, huh? But of course, PC BASIC doesn't like this sort of thing, so the labels had to be removed in favor of line numbers. After making all the necessary modifications, the program ran under PC BASIC with an elapsed time of only 24 seconds!

While figuring out some minor *Professional*-to-PC variations required within the parameters of the CIRCLE statement, I discovered another great feature as I worked on this line:

```
70 SCREEN 1: CLS: CIRCLE(160,100),70,2,,,1.4
```

Under *Professianal BASIC*, program execution halts with a "Check program" message. When I did so, the listing now displayed:

```
70 PRINT"check program": END: REM 70
   SCREEN 1: CLS: CIRCLE (160,100),70,2,~,~,1.4
```

Maybe there's something to this AI business after all! Instead of daring me to find the syntax error, *Professional BASIC* discreetly tucks in an END statement and points out the goods with a tilde (~). Surprisingly, further comparisons of execution speed in some other graphics programs revealed speed variations that were always in PC BASIC's favor, and sometimes by a considerable margin.

Speed Tests

On a FOR...NEXT loop that performs 50 math calculations, PC BASIC took 7 seconds to calculate and display the answers on my color monitor and 4 seconds on the green screen. In comparison *Professianal BASIC's* calculations took 24 and 23 seconds. However, *Professianal BASIC* is more accurate: As a typical example, a calculation that yields 542,859.9114 on my Hewlett-Packard calculator became 542,859.9 under *Professianal*

(continued on page 48)

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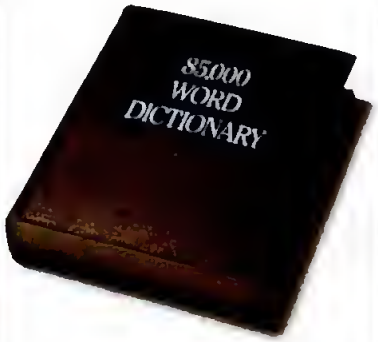


> ... this fall we can expect new WordPerfect features such as table of contents and index generation ...

PC Magazine

Right on time.

WordPerfect 4.0 features automatic generation of indexes and five types of tables, including table of contents. You simply mark words to appear in the desired tables, and generation is accomplished with just one keystroke.

> Footnoting is a good example of WordPerfect's sensible style.

Business Computing

Sensible, but not good enough.

The same footnoting capabilities garnering much praise for WordPerfect are even more enhanced in WordPerfect 4.0. Now lengthy footnotes can span multiple pages, and footnotes can be placed either at the bottoms of pages or at the end of the document. In fact, footnotes and endnotes can both be used in a single document.

> Earlier versions of WordPerfect were plagued with poorly organized documentation.

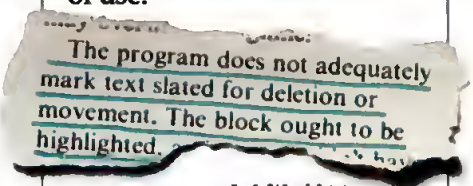
Softalk Magazine

We agree.

The documentation for WordPerfect 4.0 reflects a great deal of reorganization and improvement. Following a number of suggestions

highest marks yet.

from users and after extensive testing of the new format, SSI is excited to introduce this significantly enhanced documentation package. Many new diagrams have been added and tutorials are more extensive. In addition, the reference section is expanded and better organized for ease of use.



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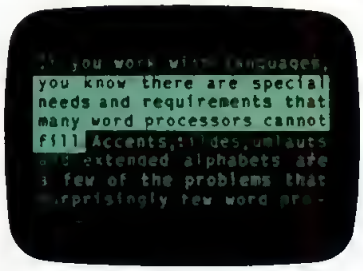

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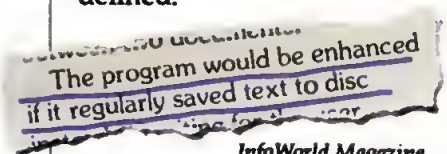

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BASIC *(continued)*

BASIC and 542,860 under PC BASIC. Going one step further, a 7 percent error creeped into a 4-year loan program under PC BASIC, while under *Professional BASIC* the loan payments balanced out to zero.

It turns out that *Professional BASIC* is faster than PC BASIC *only* if you have an 8087 coprocessor installed. Otherwise it's slower—much slower. But it is more accurate, even without the 8087.

Professional BASIC also possesses a few additional points worth mentioning:

It's error messages are most informative. For example, while Microsoft BASIC would give the message "Disk full," *Professional BASIC* tells you, "Less data was written to the disk than was requested. Check for possible disk full condition."

Unlike PC BASIC, all *Professional BASIC* arrays must be dimensioned before you run a program. This handy variation works well;

```
100 DIM A(9 to 27, 1 to 3)
```

Professional BASIC includes powerful Find and Search tools, writing and saving without line numbers, dynamic syntax checking (it's just about impossible to write a nonexecutable line of code), and EXITFOR and EXITWHILE statements.

Many *Professional BASIC* statements and commands function a bit differently than they do in PC BASIC. Some are documented and some aren't. For example,

```
PRINT TAB(n) USING
                "###.##";X
```

won't work properly, although this point doesn't show up in the manual. Use LOCATE instead; otherwise, TAB(*n*) and USING are thought to be variable names and the display line looks like

```
0 0 ###.##
```

followed by the variable *x*.

Professional BASIC saves and loads programs into memory in ASCII format only. If a program is loaded from disk and edited, you can save it back to disk under its original name just by typing SAVE. You can write your BASIC programs under most word processors, with or without line numbers. After LOAD or RUN, the filename need not be enclosed in quotes.

If you have lots of memory and an 8087 coprocessor, Morgan *Professional BASIC* deserves your serious attention. However, you will need to refer to PC BASIC as well, since the Morgan manual says almost nothing about most of the BASIC vocabulary, except where it differs from Microsoft's. That's a pity, because it makes for tough going as a standalone BASIC. There's a great deal of substance here, but the program needs better written support than it gets. ■

Comparison Chart

	Morgan Pro BASIC	Microsoft PC BASIC
Program Size (in bytes)	195,328	25,984 (BASICA, Version 2.0) 26,880 (BASICA, Version 3.0)
Minimum Memory Required	320K	48K
Space Remaining (in a 320K system)	20,640	60,865
Programs Saved as	ASCII file only	ASCII file or compressed-binary
Number of Bytes to Save Bubble-Sort Program	348 ASCII (line numbers use 5 bytes)	314 ASCII 237 compressed-binary
Extended ASCII Characterset (128-255)	Yes	Yes
Line Numbers	Optional	Required
Labels	Optional	No
Dynamic Syntax Checking	Yes	No
PC BASIC Keywords	151	180
Additional Keywords	22	None
Dynamic String Length	Yes	Yes
Maximum String Length	512	255
Numeric Data (ranges)		
Line Numbers	1–99999	0–65529
Integer (4 bytes)	−2,147,438,648/+..647	−32768/+32767 (2 bytes)
Single-Precision (claimed)	8.43E−37/3.37E+38	2.934E−39/1.70E+38
(observed)	5.92E−39/3.40E+38	2.934E−39/1.70E+38
Double-Precision (claimed)	4.19D−307/1.67D+308	2.934D−39/1.70D+38
(observed)	1.18D−308/3.59D+308	2.934D−39/1.70D+38
542859.9114 on H-P41 =	542859.9	542860
Decimal Accuracy	Absolute	Poor
Single-Precision Accuracy	6 (7th digit rounded)	6 (7th digit may be incorrect)
Execution Speed Comparisons (in min:sec)		
Bubble-Sort of 50 Random Numbers	2:13	1:25
Graphics Demo	0:25	0:24
Draw and Paint One Circle	0:24	0:09
Math Loop	0:23	0:04

Modems Call Home

All hooked up but no place to call—a lonely state for some new modem users. Now there's help. Several communications hardware packages give them a way to make a first call immediately—to the manufacturer.

Cygnet Technologies, Inc., offers an "electronic warranty card" with its product, the CoSystem computerphone. Customers are instructed to fill out a registration questionnaire on the PC and send it to Cygnet by electronic mail through the CoSystem—a practical test of whether that brand new peripheral really works.

Registered Cygnet users have already been rewarded with a free updated version of the CoSystem's software, which now offers color displays and compatibility with programs designed for the Hayes Smartmodem. Cygnet's benefit has been a doubling of the usual software and peripheral registration rate to over 20 percent.

Kudos to Cygnet for a sensible idea.

—James Langdell

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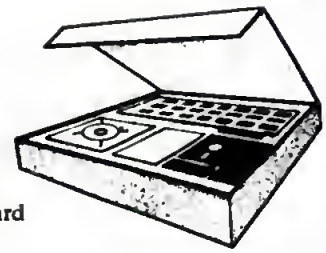

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CIRCLE 538 ON READER SERVICE CARD

Getting On-line at the Database Supermarket

BCN's giving away software to get you to give them a call.

BY M. DAVID STONE

Usually, when someone offers you something that sounds too good to be true, it turns out to be exactly that—too good to be true. Business Computer Network (BCN) of Riverton, Wyoming, is trying hard to break that rule.

The offer: Free communications software comparable to programs selling for well over $100. And, if that hasn't caught your attention, how about a 300/1200 baud, autodial, autoanswer, Hayes-compatible modem for $199?

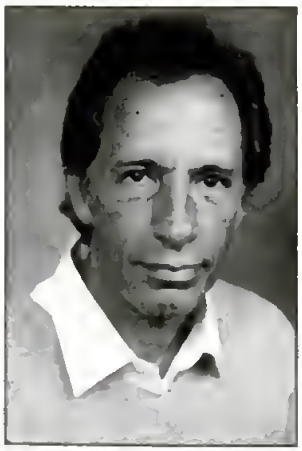
It gets better. To receive the *SuperScout* software, just call BCN's toll-free number, (800) 446-6255, and tell the person who answers the phone what kind of computer and modem you use, and then BCN will ship you the program. There's no handling charge, no charge for the disk, and not even a request for voluntary contributions, such as with *PC-TALK III*. You can also use the toll-free number to order the modem.

Database Market

The trick is that BCN is not in the business of selling software or hardware; it sells access to various on-line systems. Marketing director Arnold Schuchter says, "We see ourselves as a supermarket for databases."

BCN buys blocks of time from on-line systems at wholesale rates and sells them at retail. You pay essentially the same amount as if you had signed on directly to the on-line system, and BCN pockets the difference.

An additional benefit is that BCN customers don't have to pay a registration fee or monthly minimum on any of the systems in order to use them. According to BCN, it currently costs $300 in registration fees to join each of the 15 systems available plus an additional $200 minimum each month.



Arnold Schuchter

Minimum Use

BCN charges a $5 monthly minimum for its service. This covers 20 free "accesses" to the on-line services of your choice. Each additional call costs 25 cents. Or customers can join on a yearly basis and pay a $50 fee, plus 20 cents for each call beyond 20 per month. Either way, it's cheaper to use BCN than to use these 15 systems independently.

The systems that are available through BCN run the gamut from general-interest systems (CompuServe) to electronic communications systems (Western Union and EasyLink) to general-interest information systems (Dialog, BRS, and Orbit) to systems that are aimed primarily at business (I.P. Sharp, NewsNet, and G.E. Information Systems).

Two systems notably absent are The Source and MCI Mail. According to Schuchter, The Source should be available shortly, possibly by the time you read this. MCI Mail will eventually be added, but BCN is "not pressing" for MCI Mail because of a marketing arrangement with MCI Mail's competitor, EasyLink.

The only hitch from BCN's point of view is that in order to use BCN, you must have the *SuperScout* software and a modem. All of which explains why BCN gives the software away and sells the SmartLink II modem at a bargain-basement price. Somewhat surprisingly, though, there are no strings attached. BCN will send you the software or sell you the modem whether you plan to use BCN or not. And you can use both for telecommunications in general, not just communicating with BCN.

"We are assuming that people who get the software from us will eventually use on-line databases," says Schuchter, "And we assume they will go through us since there are no registration fees and no monthly minimums to pay—except for us."

As for the modems, Schuchter says, "I would like to see us become the major supplier of modems for the great American public."

At BCN's prices, he may just succeed. ■

Dot-Matrix Clothes Processing

An odd article recently arrived in the mail—a handkerchief imprinted with the *PC Magazine* logo and editor Bill Machrone's name and title. Was this cloth supposed to draw our attention to some new software, like the rag and squeegee Microsoft sent us to break the news about *Windows*? Or, was the handkerchief supposed to be a personal productivity tool in itself, perhaps a Nose Processor?

This wordy handkerchief turned out to be a sample created with *Reflect Text*, a program allowing you to print messages on T-shirts.

No, you don't have to feed your clothes into the printer. The program's author, C. Lamar Williams, explains how to make iron-on transfers on standard printer paper using a special ribbon with heat-sensitive ink. American Ink Products Co., of San Francisco, is a maker of these transfer ink ribbons; one dealer of its products is Express Computer Supplies, 1684 Market St., San Francisco, CA 94102, (415) 864-4949. American Ink Products's Ed Bronstein hints that the transfer ink is most compatible with poly/cotton blend fabrics.

If printing iron-on transfers is as simple as that, why do you need Williams's specialized software? Well, remember those transfers you used to get in bubble gum packages? In raw form, they were mirror images of the final pictures, including reversed lettering.

Since the PC doesn't provide a cStrP key for doing backwards printing, Williams designed *Reflect Text* to handle that part of the job. A few lines of your text print out in reverse in a choice of several type sizes. The software can be obtained from some public-domain libraries or by sending $10 to Williams Software & Services, 1114 Pusateri Way, San Jose, CA 95121, (408) 227-4238.

Reflect Text requires 96K RAM, DOS 1.1 or higher, a color graphics adapter, and a hot iron. —***James Langdell***

"We decided waiting *another* decade for the standard in business software was too long."

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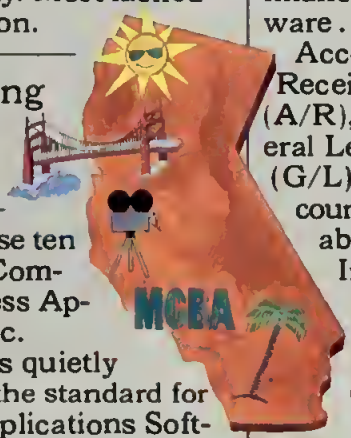
Hundreds of microcomputer business applications packages from scores of programmers were rushed to market during the last ten years as the microcomputer became an everyday business tool.

Many were fine packages—filling niches, stop-gapping problems, allowing the businessperson to *maintain*—probably not drop behind, but definitely not surge ahead.

What was missing from these packages varied from package-to-package. Some lacked power. Some, simplicity. Others, clarity. Most lacked real integration.

Introducing Some *Old* Software



During those ten years, Mini-Computer Business Applications, Inc. (MCBA), was quietly establishing the standard for Business Applications Software for minicomputers.

Today, much of the new software developed by other companies boasts compatibility with MCBA's packages.

Macola, Inc., finding the current micro-packages unacceptable against the standards they sought, and realizing the time involved in developing their own set of packages, approached MCBA, obtained the rights to convert the powerful minicomputer software, then did just that.

Thanks to Macola, the micro-computer industry can now run the *Micro-Standard* in the following financial software...

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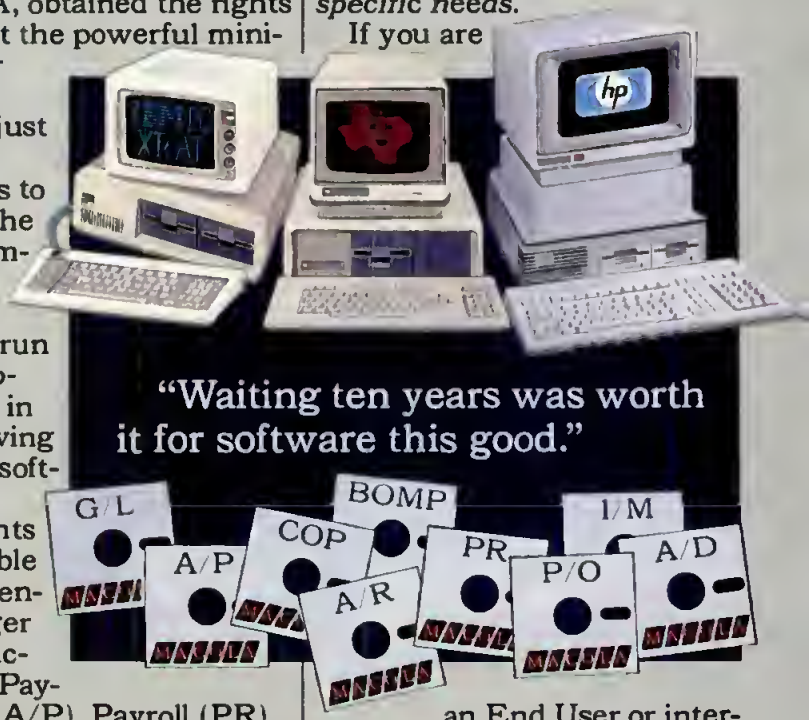

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CIRCLE 263 ON READER SERVICE CARD

ANALYSIS

Stalking the Next 1-2-3

Marketing execs from other industries spread the "blockbuster" attitude in the software market

BY MARTIN PORTER

The ad for *Symphony* in the *New York Times* proclaimed: "It's a Hit!"

A "blockbuster" attitude has emerged in the computer software business, so much so that many companies—even Lotus Development Corp.—live with the hope that their next product will be the next *1-2-3*.

The result has been massive expenditures of development capital to get a blockbuster to market, as well as elaborate marketing schemes to promote software brand names in American households as if they were laundry soap or toothpaste.

As new Ashton-Tate president Ed Esber explained in a recent *PC Magazine* interview, this blockbuster mentality has "raised the expectations of the industry—especially the press—beyond what is realistic."

Illustration: Reynold Ruffins

Hit or Miss

In a climate where everyone is looking for "the coming thing in software", an assortment of credible products is being overlooked. Some journalists at trade shows spend more time reading the ads in the trade journals than hitting the floor, testing the software, and discovering the next great product for themselves.

Sentiment is brewing in the software marketplace that things must change.

"It is true that the 8086 is Intel's blockbuster product," says Regis McKenna, the computer impresario who launched the marketing efforts for both Intel and Apple Computer. "It creates a lot of attention, but Intel has thousands of products in its product line. It couldn't survive on the sales of one product alone—even a blockbuster."

Such talk about software blockbusters evolves from the fact that 1984 was the year the computer business fell in love with television advertising. Software peripheral manufacturers tried to keep up with Apple and IBM in TV ad expenditures. Some analysts now question if the software companies were simply trying to force blockbusters into being, since these outlays can't be justified by sales alone.

Fame and Fortune 1000

"Software is not a mass-market item," explains Jack Godler, editor of *Computer Advertising News*. "To sell software you really have to sell the Fortune 1000 companies. How many real decision-makers do you have to reach at those thousand companies? You don't have to spend television dollars to reach them, believe me.

"We're not selling Pepsi Cola."

If not, then why is the computer business drawing executives from the soft drink business? Steve Jobs picked Pepsi heir-apparent John Sculley to skipper the Apple line, while Mitch Kapor went head-hunting at Coca Cola for Hank Cardello, who's now the new marketing director at Lotus.

"You have to take the best principles from the soft drink industry," he elaborates. "For instance, how to kick off a new product and how to clearly identify your target audience. But then you have to consider the differences. When you look at a soft drink, you know what's inside; with software you need an education."

Medium Is Cool

"TV is not a waste of money if it is being used to generate rapid awareness," Cardello explains. "Rapid awareness was the first phase in our plan for marketing *Symphony* both on TV and in print. We have since gone into phase two, in which we tell consumers what the product really does."

This all assumes that manufacturers sell software to the consumer, whereas traditionally dealers have pushed software hits up the charts.

"Software's top ten has very few new titles," says Regis McKenna. "That's because there is a certain amount of training that goes into selling any software product. Retailers are driven to sell what they already know."

But others say that times have changed and that dealers are now ordering inventory based on requests from customers. "The manufacturer makes the hit today," say Lorraine Mecca, president of software distributor Micro D.

When asked if Lotus, as its advertisements proclaim, has a hit on its hands with *Symphony*, Mecca responds that it is indeed her number one new product. She admits, however, that it is being outpaced two-to-one by sales of *1-2-3*. "Everything today is being measured against *1-2-3*, and if you're using that as a measuring stick, everything is going to fall short."

Still, the blockbuster remains the dream of every software developer. Software is inexpensive to manufacture and, if the public takes to a program, it will virtually sell itself for years to come.

Unfortunately, computer software rarely sells without a push. At least this is the perspective of Ron Tepper, a promotion specialist from Torrance, Calif.

Tepper is a newcomer to the computer market, but he wrestled with a blockbuster in the early 1960s when, as director of publicity at Capitol Records, he helped promote the Beatles in the United States.

Still, he saw problems at last November's COMDEX exhibition that no rock promoter ever had to confront. "Computer software is a tough business," he notes. "You've got to explain too many things. There's too much of a gap between what the industry sees and what the consumer understands.

"You should never have to explain a blockbuster. You don't have to explain Michael Jackson or Jane Fonda, do you?" ■

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CIRCLE 135 ON READER SERVICE CARD

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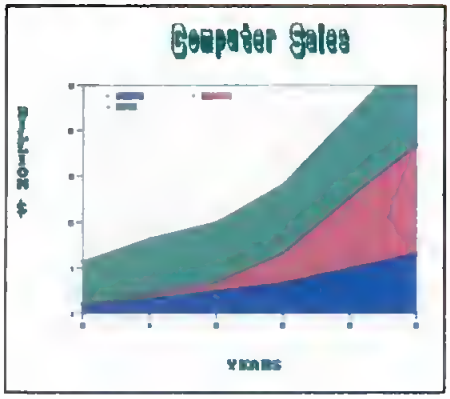

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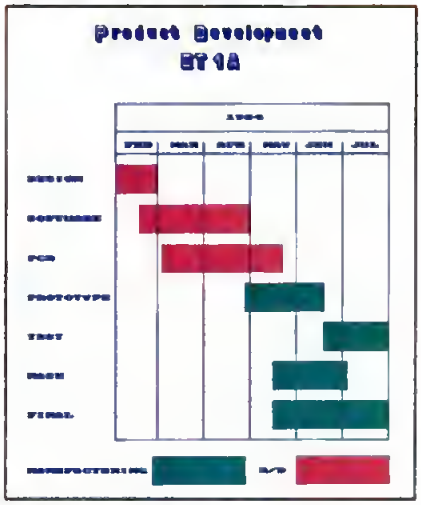

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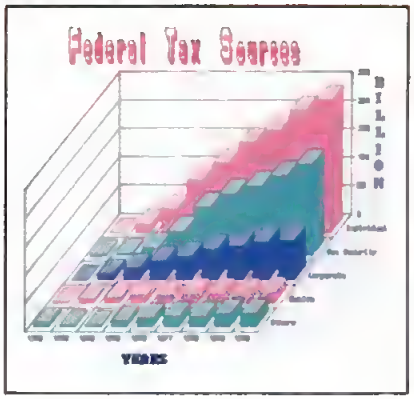

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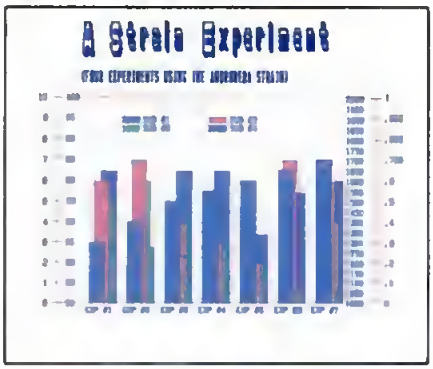

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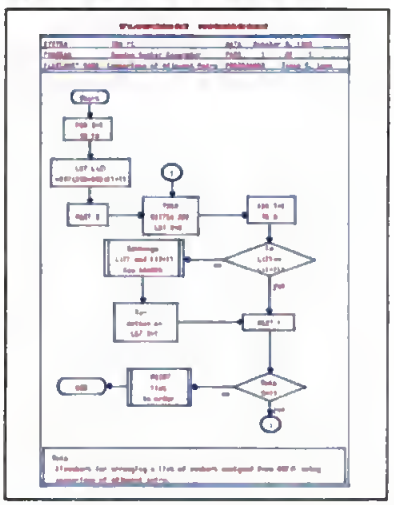

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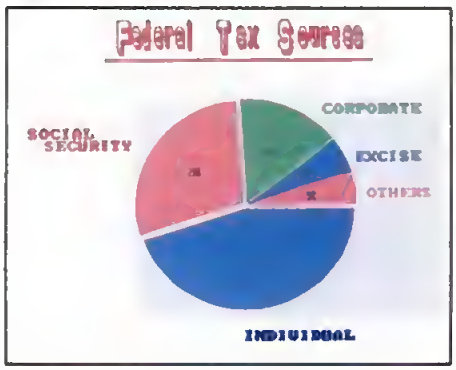

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CIRCLE 134 ON READER SERVICE CARD

PRODUCT REVIEW

Dial PC for Savings

BY TOM BADGETT

PhoneChek
Xiox Corporation
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San Mateo, CA 94402
(415) 571-7911
List Price: $279
Requires: 128K RAM, one double-sided disk drive, 80-column display.

One thing office managers and business owners need to know—but rarely do—is how the monthly telephone budget is spent. Small businesses, particularly, often find it difficult and time-consuming to analyze telephone costs. Xiox Corporation's *PhoneChek* software makes it easy to get regular reports on long-distance calls, grouped in a variety of ways.

Complete information on every call is typed into the computer each billing period. A single floppy disk can hold information for up to 2,000 calls. Once the information is on disk, the software produces reports with just about every conceivable grouping of call information. You can enter up to four account codes for each call, and you can use the account codes from your general ledger or assign numbers to different kinds of calls. A law office could assign different numerical codes to each attorney, for example, then have separate numbers for office business, client support, personal calls, and so on. With four account codes per call, the breakdown of charges is fairly complete.

PhoneChek also details calls by area code, date and time, office extension, cost, duration, or number dialed. "Expensive Call" and "Long Call" limits can be set to help you quickly spot abnormally long or costly conversations. You can summarize each grouping so you can see totals by date, account code, or other designation.

Smaller Offices

"We've designed *PhoneChek* for the smaller office—attorneys, doctors, and other professionals, for example, who can't justify the cost of our dedicated products," says Barbara Brown, *PhoneChek* marketing manager. "Now that we're seeing the merging of telecommunications and computer technology, *PhoneChek* is an obvious choice for a company already using a PC."

Brown says the *PhoneChek* package is for offices with monthly telephone charges of $1,000 or less and fewer than 2,000 calls. Xiox Corporation markets telephone management products exclusively.

The software is easy to use because all data entry is on a formatted screen with predefined fields. The program sets the PC's NumLock and CapsLock keys when it loads, so all data entry can be done with the numeric key pad. The plus sign (+) and minus sign (−) keys move the cursor ahead and back in an input record. The Return key stores the current record. The asterisk key means "Yes" or "Go ahead," so your hand rarely has to leave the numeric keypad while using *PhoneChek*.

Some Static

A few little inconveniences make the program less than perfect. Each call record must be entered entirely from the keyboard, for one thing. That means if you have 20 calls on one day, the date must be entered 20 times. Or, if you have a series of calls to the same area code or phone number, each must be entered individually. It would have been more convenient if the program remembered the last entry and kept it by default unless you typed new information in that field.

The call editing program is difficult to use. You must enter the date, hour, and the first three digits of the number you want to find before the editor will search for your call, limiting the editing flexibility.

This editing procedure makes it inconvenient to enter calls at the end of each day during the month, then only update the length and charge categories when your monthly bill arrives. If you could start at a specified number, update it, then scroll to the next one on file, the data entry process could be spread across the month, speeding the creation of period reports.

And when you exit *PhoneChek* to another application, you'll find that CapsLock and NumLock still are set. A software package that changes your hardware settings should restore the original settings for a clean exit.

Overall, though, *PhoneChek* is quite useful. It gives you regular feedback on telephone costs and help with tax returns by allocating communication costs to various tax accounts. And, even though redundant data entry is required, using the software is easy enough to prevent procrastination. ■

Video Gamers Score High for Their Eyes

Although controversy still rages over whether VDTs are harmful to the eyes, an eye researcher claims video games can actually help cure at least one visual ailment. Called amblyopia, it's a condition known as "lazy eye" that's most often treated in childhood. The patient wears an eyepatch over the dominant eye, forcing the lazy eye to exercise and contribute more to the child's vision.

The eyepatch alone isn't sufficient to improve some children's vision. In an experiment, Sarah Shippman, chief orthoptist at the New York Eye and Ear Infirmary in Manhattan, treated some of these children by having them play video games while eyepatched to make their lazy eyes work harder. The results have been good: Vision improved for 15 of her group of 19 patients, ages 4 to 10, who hadn't been helped by eyepatches alone.

What difference do the video games make in this treatment? Shippman says the most important part of the therapy is to get the child to concentrate on using the weak eye to look at an object in the distance. Video games provide attention-holding images of the right size. "The images in television programs are too large to be an effective visual target," Shippman explains.

Over a period of weeks, whenever a child would start to score high consistently, Shippman would move the TV further away to increase the challenge and teach the eye to see at greater distances. Usually, a lazy eye would be up to full strength by the time a child could play *Ms. Pac-Man* at a distance of 20 feet.

When test results confirmed how therapeutic video games could be, Shippman tried to develop software specifically for treating amblyopia. "I thought I could make a killing with a product like that," she said. She found, with some regret, that off-the-shelf video games could hardly be bettered. The variety of commercial programs had medical advantages as well. "You need a constant supply of new games to keep the patients interested long enough to improve their vision. These kids were hip—they only wanted to play the newest games."

Another factor discouraged Shippman from selling a program like *Amblyopian Invaders*. "It would be a self-limiting market. Once children use the program, their vision improves permanently and they don't need it anymore." Fortunately, the game makers' products are more profitably addictive.

—James Langdell

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CIRCLE 535 ON READER SERVICE CARD

PCs Elected for Duty in New Mexico Statehouse

Selling to the state government can be a lucrative business.

BY CHARLES BERMANT

SANTA FE, N.Mex.—When Al Harding scouted this town for a ComputerLand franchise, he saw two lucrative contracts ripe for plucking: The Los Alamos Scientific Laboratories 30 miles up the road and the New Mexico state government. IBM itself eventually aced him out of Los Alamos, but he is well on his way to achieving the other half of his original goal.

Harding says that he now gets $100,000 a month in state business. And he claims that his small store makes more than all four of the chain's Albuquerque locations.

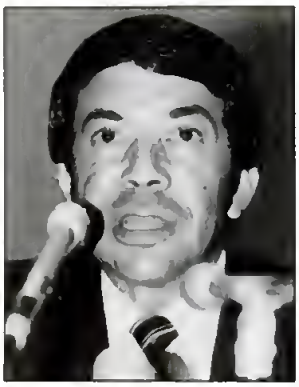
At 24, it's surprising that he has harbored the ambition to manage a Computerland for half a decade. He had always wanted to go into business, he says, and even skipped the obligatory college degree. But he didn't know that selling to state government would demand that he become proficient at political machinations.

"Everything is geared around politics," he says. "If I make the governor unhappy, I won't sell any more PCs to state government until after the next election. I walk on eggshells determining the difference between what the governor says that a certain agency needs and what it really needs."

We've Only Just Begun

Two years after Harding started his PC assault on state government, which coincided with the election of Democratic Governor Toney Anaya, only a handful of the more than 60 state agencies have felt the impact. Still, those PCs have been enough to make a difference, and other states have called up to find out how it's done.

"You end up generating the same documents that you have before," says Miguel Nuñez of the State Investment Council. "But the approach is different. It has created a new subset of people, intermediaries between financial analysts and programmers. They can manipulate data more easily.



Gov. Toney Anaya

"Since in politics you only have *x* amount of time, you need a concise document that will enable you to get your point across within the time you've been allotted to say something."

Nuñez's agency is charged with investing $2 million in idle state funds in a specific portfolio mix. Regulations mandate a monthly report: "With a manual system, it was virtually impossible to get the report finished on the 10th of the month as required," says Anne Schulter of the agency. "Now we're getting it done on the 4th."

"PCs don't relieve you of any work," says Dennis Hazlett of the Legislative Finance Committee. "They just put it in a different context. The level of analysis is getting higher. After 12 years of this kind of work you get stale. Now, I'm learning things anew, stuff that I've never thought of before.

"We're now able to analyze an agency's productivity in relation to its budget. We get better analysis. But it won't make things any easier. Every time you innovate, you create a new demand. The more you give, the more they want."

Hazlett's agency is charged with supplying financial information to the legislature while it is in session. A separate group completes the same task for the governor, and the two groups hammer out a state budget after an intense fiscal battle.

Harding, who has equipped both sides with equal hardware and software configurations, is the arbiter of this great conflict. He has created a modern-day Hamilton-and-Burr duel. And the PC is the weapon of choice.

It seems clear that PCs will make a considerable difference in the upcoming legislative session. Governor Anaya's programs have come under a sharp attack and observers expect this year's session to be contentious. The action will be faster because of the computers on both sides.

"The strategy in the legislature," says Hazlett, "is that whoever controls the information has the advantage."

Future Shock

While he concedes that "some of the secretaries are scared to death" of computers, Harding says that most of the state government people he has served have been easy to deal with and accommodating—except for those in the governor's office.

"We gave the governor's office 400 hours of free training," he says. "I lost money on that. The governor told everyone to start producing instantly, and you just can't do that after only 2 hours of training."

Harding says that one Friday afternoon, the governor's office insisted that he have an appointment scheduling program ready for use by the following Monday. He balked, saying it was "impossible," but they wouldn't listen to reason. He eventually spent a sleepless weekend designing the software, and the program was in place the following week.

"You can't tell them no," he says. "What the office wants, they get."

Subsequently, he says, one long-time state house observer told him that no other vendor had stuck it out as long as he, and that observers were "surprised that you cut through all this baloney and are still doing the job."

Governor Anaya, who cannot succeed himself, will leave office in 1986. But Harding has already hedged his election bets by selling PCs to many of the expected gubernatorial contenders. He remains hopeful that his service to the state will have as smooth a transition as the change in administration does. ■

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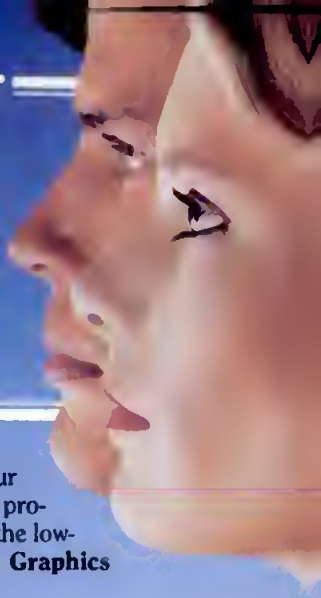

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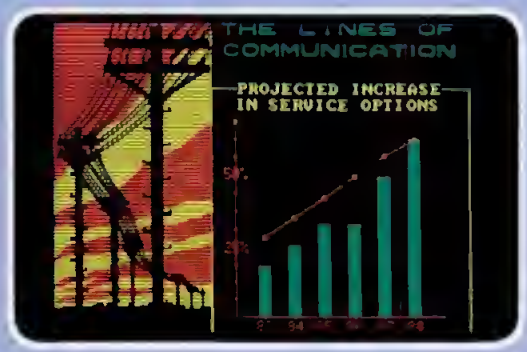

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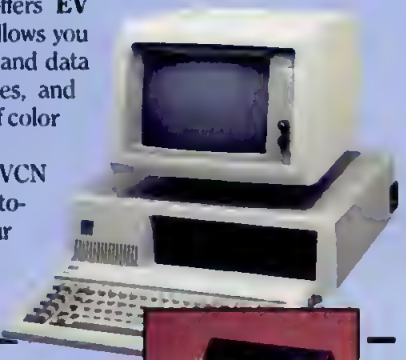

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PCs Prove To Be The Real Estate Thing

PCs help to change the way some realtors sell property.

BY ERIC FREEDMAN

KALAMAZOO, Mich.—If you're in the market for a home, an office building, investment property, or a farm, a pioneering computerized video system could change the way you look for—and at—real estate. Using photographs stored in a central computer, REAL/NET can reproduce the pictures in color on a local realtor's monitor. In addition, detailed information on each property can be retrieved easily from a comprehensive database.

First installed in the offices of members of the Kalamazoo Board of Realtors, REAL/NET could some day replace the traditional form of multiple listings—books with tiny black-and-white photos and a few basic details about each property. It's the brainchild of I/NET, Inc., president James Knapp, a data processing manager whose personal frustrations in searching for investment property 4 years ago sparked the concept of "marrying video with computing." Knapp recalls, "I was unhappy with the process of driving long distances to see properties I didn't like, so I designed a system with me in mind."

The result allows prospective buyers to sit at a personal computer and look at a number of properties, saving wasted travel time. And its search capabilities let REAL/NET quickly profile a buyer's preferences and match them against available listings in the database.

In developing REAL/NET, Knapp scoured the country for firms doing computer graphics and bit mapping for digitalized video images. He founded Scion, in Reston, Virginia, to help design a system using direct video input to capture photographic images and transmit those images economically. The system was designed with the IBM PC as the anticipated terminal of choice.

The REAL/NET system contains data on every street in a 3,000 mile area.

Selling the System

Some potential customers were skeptical. The Kalamazoo Board of Realtors, which eventually became his first client, "talked to me only because I discussed imaging, and everybody else said it was 5 years away." The board had been in the market for a computerized database system for about 2 years, and Knapp's "selling" process included weeks of education and demonstrations, as well as correcting what he called "misinformation" from competitors. Then in February 1984, the board signed a $1.3 million contract for a system that would transmit black-and-white photos at a rate of one every 30 seconds.

Several events intervened between then and October, when installation of the system began. For one, AT&T released its personal computer. Coupled with new developments in graphics and telecommunications, the price of software, training, hardware leases, and support dropped to $961,000 for a 5-year period; photos became available in color, and transmission time plunged to less than 5 seconds per picture.

Each participating office in Kalamazoo received an AT&T PC with 256K RAM and two disk drives, a black-and-white video printer, a NEC dot matrix printer, a Sony color monitor, and a modem. Knapp expects that future installations will include a color video printer. REAL/NET also supports realtors who already own IBM PCs and color monitors.

The system is housed in an IBM System/38 at I/NET headquarters in Kalamazoo. Its capacity is about 30,000 properties with 8 color photos of each. Because the board members average only 4,500 active listings at a time, the excess capacity is used to store information on properties already sold, making it easy to retrieve historical data for price comparisons.

Images are passed over voice-grade lines in quarter-screen size. The pictures can then be blown up at the terminal to full-screen size, or as many as four photos of the same property can be displayed together.

The heart of REAL/NET's search abilities are an area database listing every street, lake, school district, municipality, and neighborhood in the board's 3,000-mile territory, and a detailed questionnaire for each building or parcel of land added to the system. Board president William Reed calls REAL/NET's search capacity "the difference between night and day."

With the menu-driven program, users can call up as much detail as they want—for example, number and dimensions of rooms, price, listing broker, outstanding mortgage balance, type of heat, past utility costs, landscaping, financing options, tax assessments, fireplaces, swimming pools, even roofing and siding materials. Those and other variables can be used to search the database for available properties to meet a would-be buyer's desires. Buyers' preferences also can be stored, and the proper realtor is notified by REAL/NET when an incoming listing matches one of those profiles.

The cost to the board and its members is considerably higher than standard multiple listing services, Knapp admits, but he estimates a pay-back period of only 2 to 3 years. He doesn't foresee the system forcing small brokers out of business, even though they may have difficulty paying their share of the cost. Instead, he predicts, "they'll be in the same building with their own shingles, but they're going to join together to share resources." ■

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People in the News: Paul Funk

A song parody inspired Paul Funk to turn spreadsheets on their side.

BY VIRGINIA DUDEK

CAMBRIDGE, Mass.—The muse that visits software developers may be fickle, but once in a while it's willing to help the dedicated entrepreneur.

Back in 1983, Paul Funk visited a computer store while working on a software program. He was watching a *VisiCalc* spreadsheet printing out in MX-100 compressed mode. Funk also just happened to have a friend who likes to think up parodies to popular songs. In the back of his mind, Funk heard the revised lyrics to a Bobby Darin song made popular by Frank Sinatra; "I did it sideways."

"In typical Hobbesian fashion," says Funk, "the two ideas came together into one entity." Funk stopped what he was doing and wrote *Sideways*.

Paul Funk

Sideways, a program that prints spreadsheets sideways so that hundreds of rows of figures can print continuously, derives much of its success from what Funk calls its simplicity and universal appeal. "It actually took less time to write than the other program I was working on," he says. Without using venture capital resources, Funk did a small amount of advertising with his own money. The product got rolling, and soon *Sideways* gained a strong position in the personal computer utility market.

Funk has since added new printers to *Sideways*, plus versions for DEC Rainbow, Texas Instruments, and Wang computers. This spring will see the release of new features for the PC version that Funk says will "dramatically" expand the system's capabilities.

Funk notes that Funk Software is in a new phase of development. Currently employing four (including Funk), the company is looking into further development of software utilities and business products.

"I enjoy being in a small company," says Funk. "It's more personal, and I might not be happy in a large company." Funk still does not operate with venture capital money; all operating funds are from the company earnings.

"In the model of starting with a lot of venture capital money, the marketing effort is begun at the same time as the development effort. Since *Sideways* is a niche product, early investment is not necessary because of a lack of competition and because news of the product travels by word of mouth."

The next product to come out of Funk Software may or may not have the same angle as *Sideways*, but Paul Funk will probably go on thinking somewhere along those lines. ■

Photo: Wendy Cross

Calendar of Events

DATE	EVENT	COMMENT	LOCATION	CONTACT
March 4–7	Interface '85	Systems and services for large scale corporate, government, and institutional users.	Georgia World Congress Atlanta, GA	The Interface Group 300 First Ave. Needham, MA 02194 (617) 449-6600
March 11–13	Exploding the UNIX Myth	Discussions of UNIX and IBM's strategy in the UNIX market.	Grenelefe Hotel Orlando, FL	Gartner Group, Inc. 72 Cummings Point Rd. Stamford, CT 06904 (203) 964-0096
March 21–24	COMDEX/Winter	Hardware, software, and accessories.	Anaheim Convention Center Anaheim, CA	See Interface (above)
March 30–April 2	The 10th West Coast Computer Faire	Hardware, software, peripherals, and services.	Moscone Center San Francisco, CA	Computer Faire, Inc. 181 Wells Ave. Newton, MA 02159 (617) 965-8350 (415) 364-4294 (CA office)
April 23–25	Federal DP Expo	Computer, data communications, and office automation systems.	Washington Convention Center Washington, D.C.	See Interface (above)

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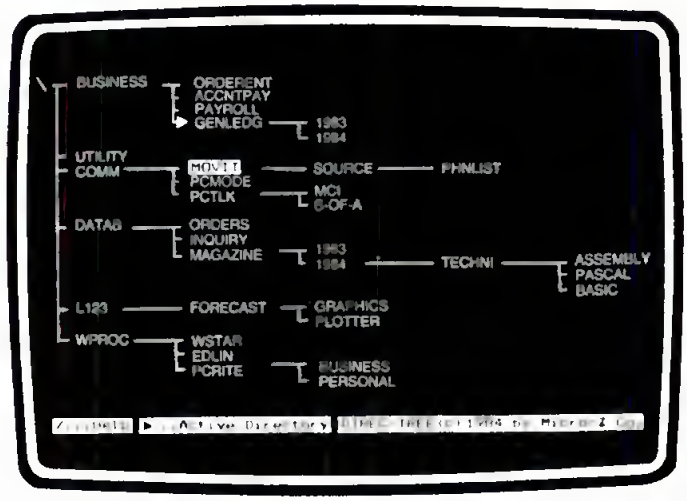

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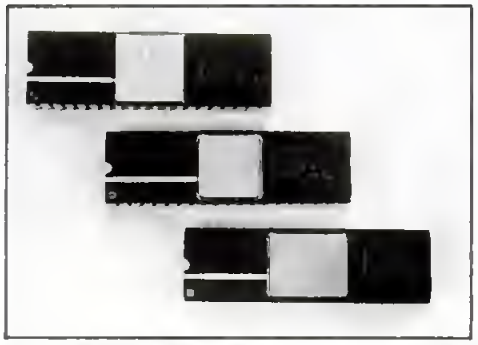

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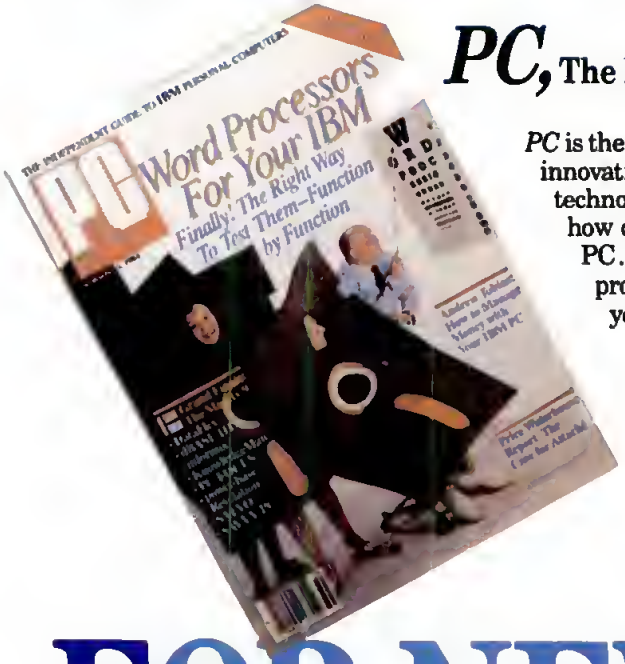

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PC Magazine Feb 19 March 5 1985/PC World March 1985 Submitted Dec 15, 1984

CIRCLE 242 ON READER SERVICE CARD

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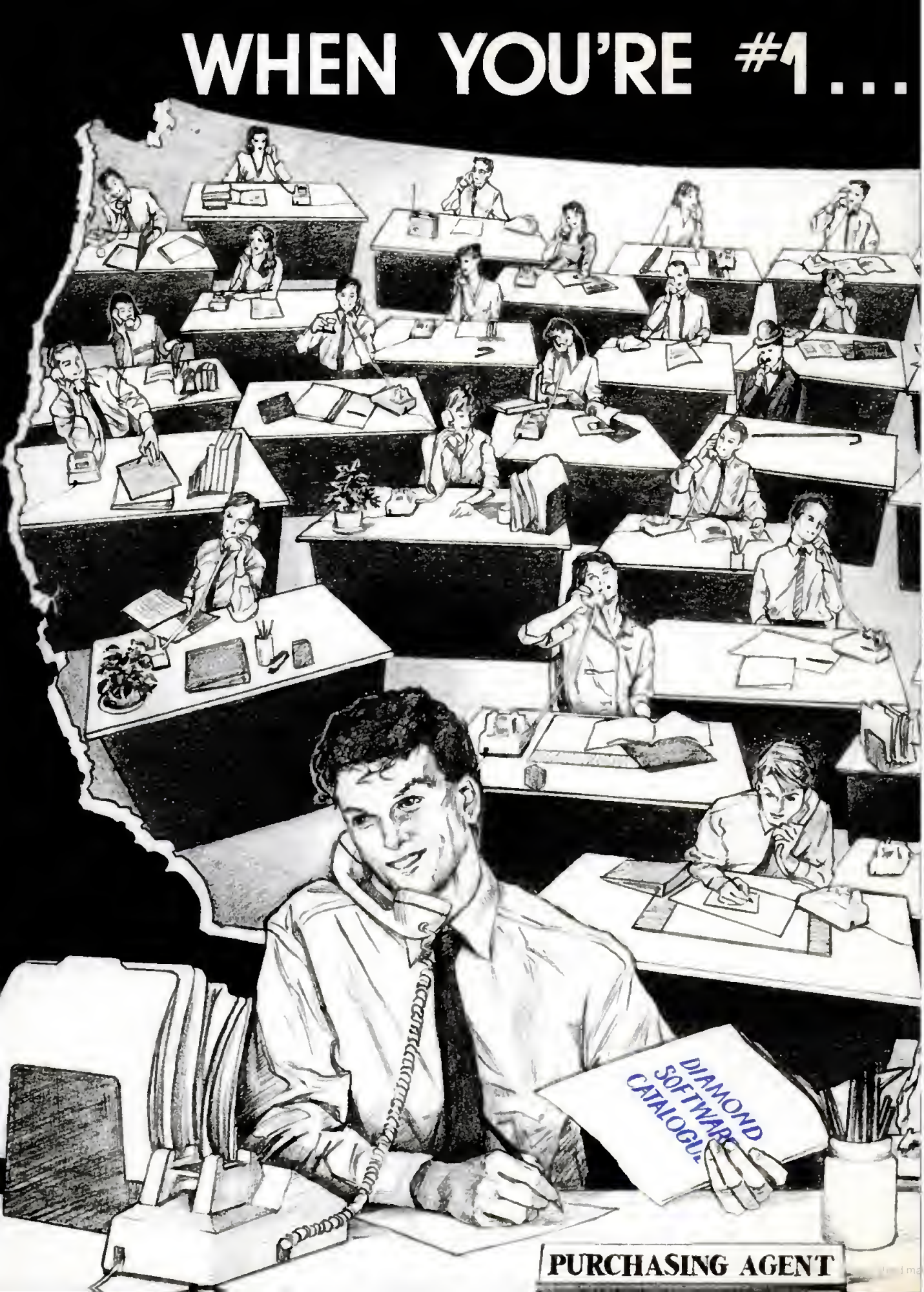

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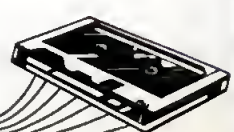

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Worshipping Mi Tu

The microcomputer revolution is floundering as innovations get crowded out by products that merely rework successful formulas as they follow the leaders of the PC-compatible pack.

I don't know how to put it delicately. It's not an easy thing to say. But lately, the personal computer has become, well . . . boring.

Yeah, I know, I know. Someday we're going to see all sorts of wonderful graphics stuff, and voice recognition's just around the corner, and there's that guy in Gold Rush, California, who promises to turn your PC into a robot that'll do everything but walk the dog.

Great. Soon. Any day now. Maybe the free enterprise system will bring about some sort of golden age of computerdom. But I'd be a lot more sanguine about it if most of the free enterprisers in the business didn't happen to be worshipping at the altar of that venerable and wrathful god, Mi Tu.

I don't want to deny anyone the chance to make a buck, and I know that it's only natural that a good idea will spawn a gaggle of imitators. However, when the imitators threaten to suffocate the innovators, something needs to be done.

Send in the Clones

Unfortunately, fanatic devotion to Mi Tu reaches deep into all segments of the industry. If it isn't word processors, it's database systems or project managers (managed a good project lately?). No matter whether it's hard disks, printers, or PC-compatibles, the pattern's the same. So many new products are just marginally better than their established competition—or not even as good.

I'm afraid that it's often less a matter of choice than of ability. Just about any decent programmer can reverse-engineer an adequate word processor or spreadsheet. Figuring out something new to do with a computer demands talent of another order.

Stephen Manes

Worse, program developers as a group seem to be falling back on their training in the mainframe world, where captive users are forced to live on a diet of whatever the in-house software chef cooks up. The mainframe tradition is software that's easier for the programmer to create than it is for the user to make work. The good enough drives out the good.

Even when they get decent software ideas, programmers often don't seem to bother checking out their stuff in real-world situations. PC systems are getting more and more complicated, but somehow, most programmers just assume that everyone uses a plain-vanilla computer and that playing by the documented rules will make everything okay. Nasty software interactions are a dirty little secret quietly dumped in the user's lap.

For example, just about every computer user I know has some form of RAM-disk software and a keyboard enhancer. This year's good software idea is the memory-resident program: notepads, calculators, and phone dialers that sit in the background waiting to be called up at the touch of a key. Unfortunately, the ones I've tried cause unpredictable and irretrievable crashes with my setup. It can be argued, of course, that the original programs are the ones that cause the crashes, but since the notepads are the ones that came late to the party, their programmers should see to it that they don't break the host's china.

Part of the problem is that getting a new program to market has become a Sisyphean exercise in itself. Computer dealers naturally prefer the big-ticket, high-markup item to the dazzling $40 utility. Selling by mail order is one way

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to get around the dearth of space on dealers' shelves, but it's a job that most developers aren't ready for. Book publishers have begun jumping into the software waters, but the tide seems cold, and already at least one has jumped back out. Maybe that's because its lead product was sameware: yet another "full-featured, easy-to-use word processor." If it had put out something genuinely interesting, like a creative epithet generator or a menu-driven punk haircut styler, it might've attracted some attention.

Knock Our Socks Off

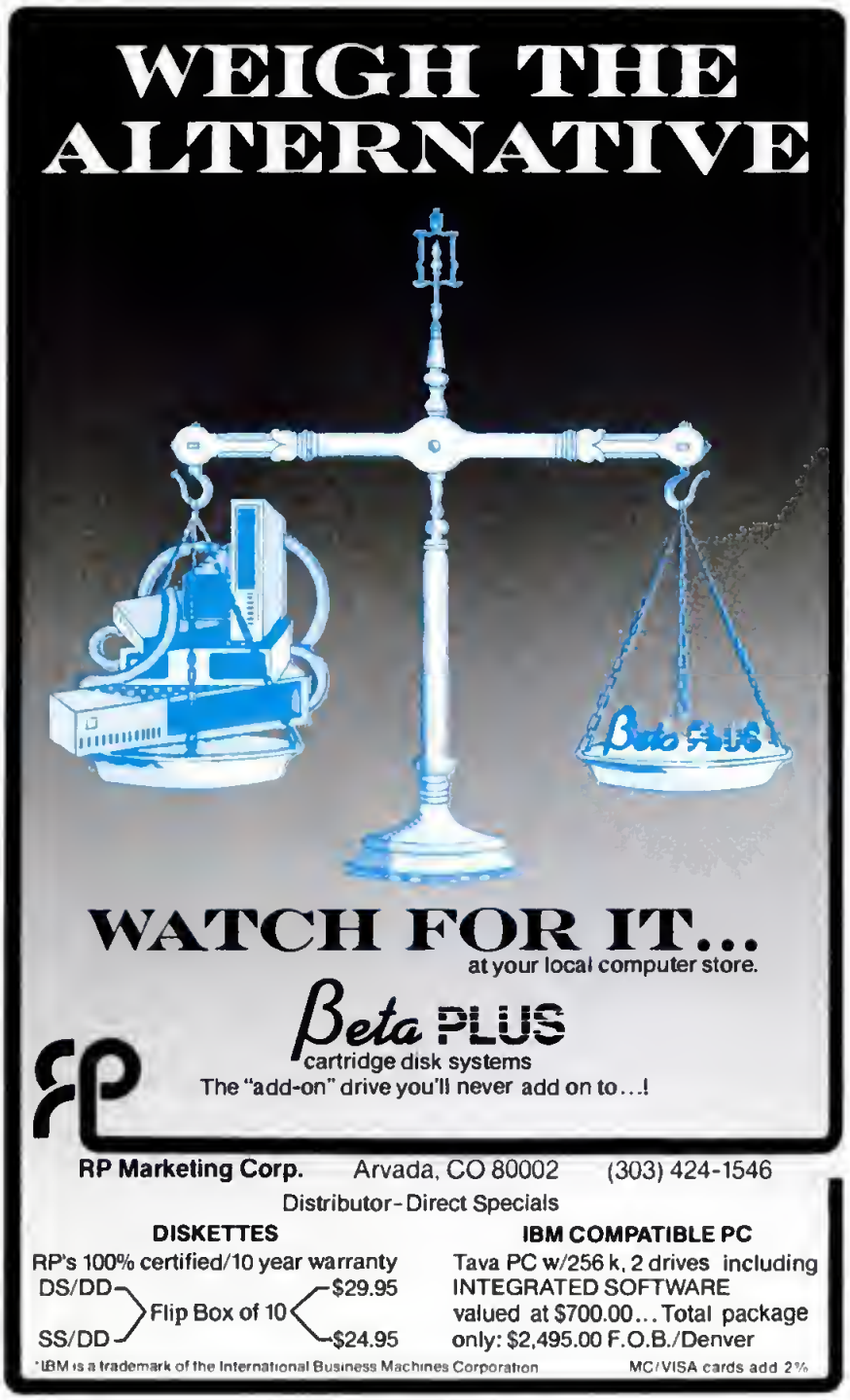
As it stands, the personal computer "revolution" is beginning to mean nothing more than giving a small business the computing power that only a big one could have afforded 10 years ago. The Big Four software categories—database managers, word processors, financial planners, and telecomunications programs—have been around for ages in the mainframe world. It's dandy to have them on a desktop computer, but a truly powerful innovation such as the microcomputer ought to have implications that extend beyond the realm of what's needed in a Motor Vehicle Department.

As has been demonstrated over and over again, software drives hardware. Video games sold millions of Atari game machines. *VisiCalc* moved Apple IIs, *1-2-3* sold PCs, and *MacPaint* is selling Macintoshes. High-powered word processing is probably selling as many machines as any other single application.

All these applications were tremendously exciting when they first arrived on micros. Now we take them for granted and jadedly keep asking: "Can't anybody come up with some products that'll knock our socks off—again?"

One reason Apple's Lisa and Macintosh got such good press in the early going was that at least they looked like nothing else, and their (mostly software-driven) flash and dazzle obscured the maddening (and mostly software-driven) ineptitudes of the machines themselves. Today, Lisa is a dead duck, and Mac seems to be a poor rendition of an interesting idea, but at least Apple didn't go with the PC-compatible pack.

And if IBM is smart, I suspect it won't make its next machine look like a cute MacClone from the altar of the great god Mi Tu. ■



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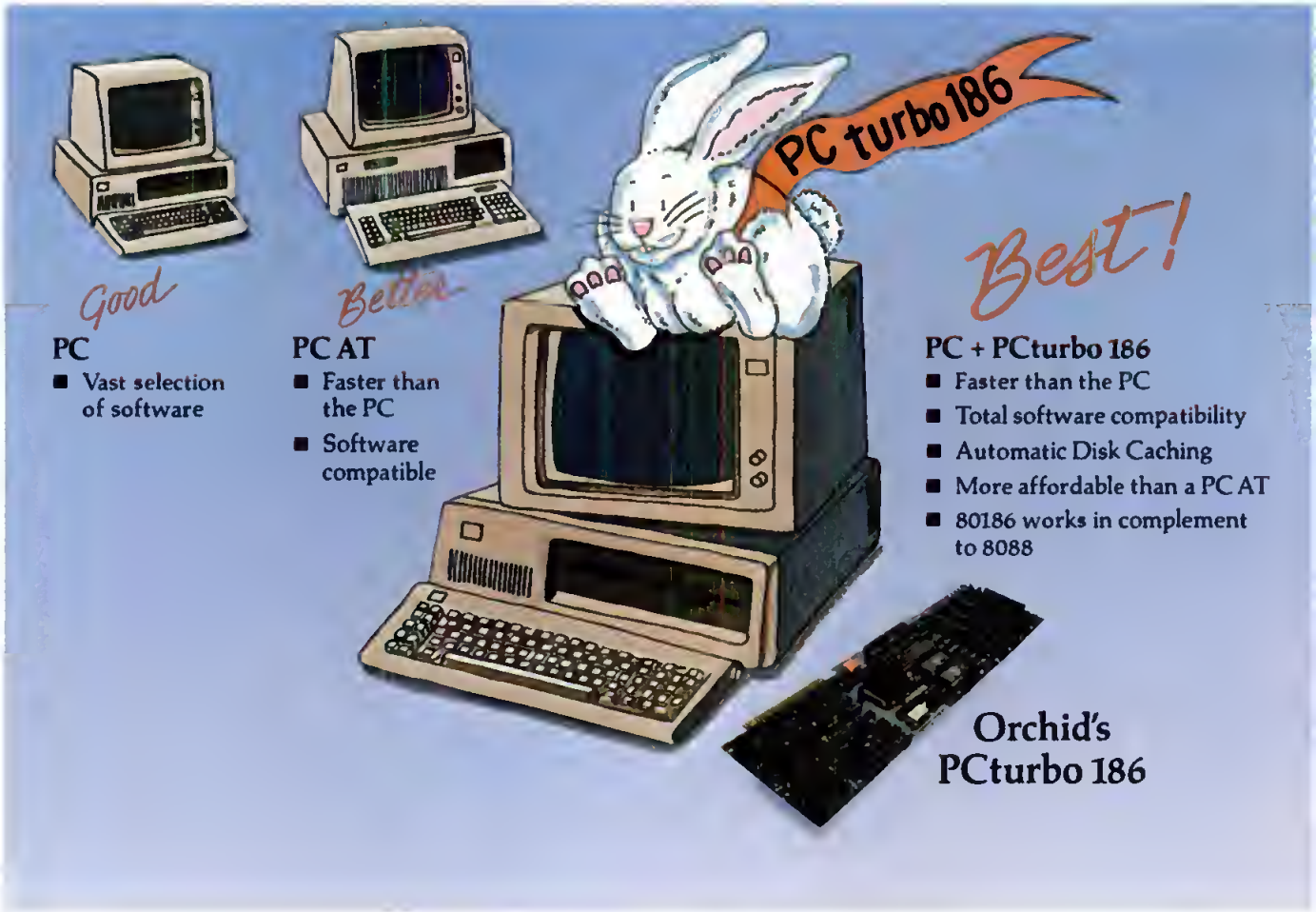

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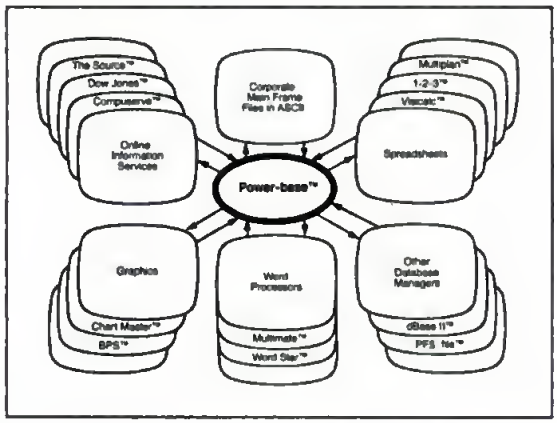

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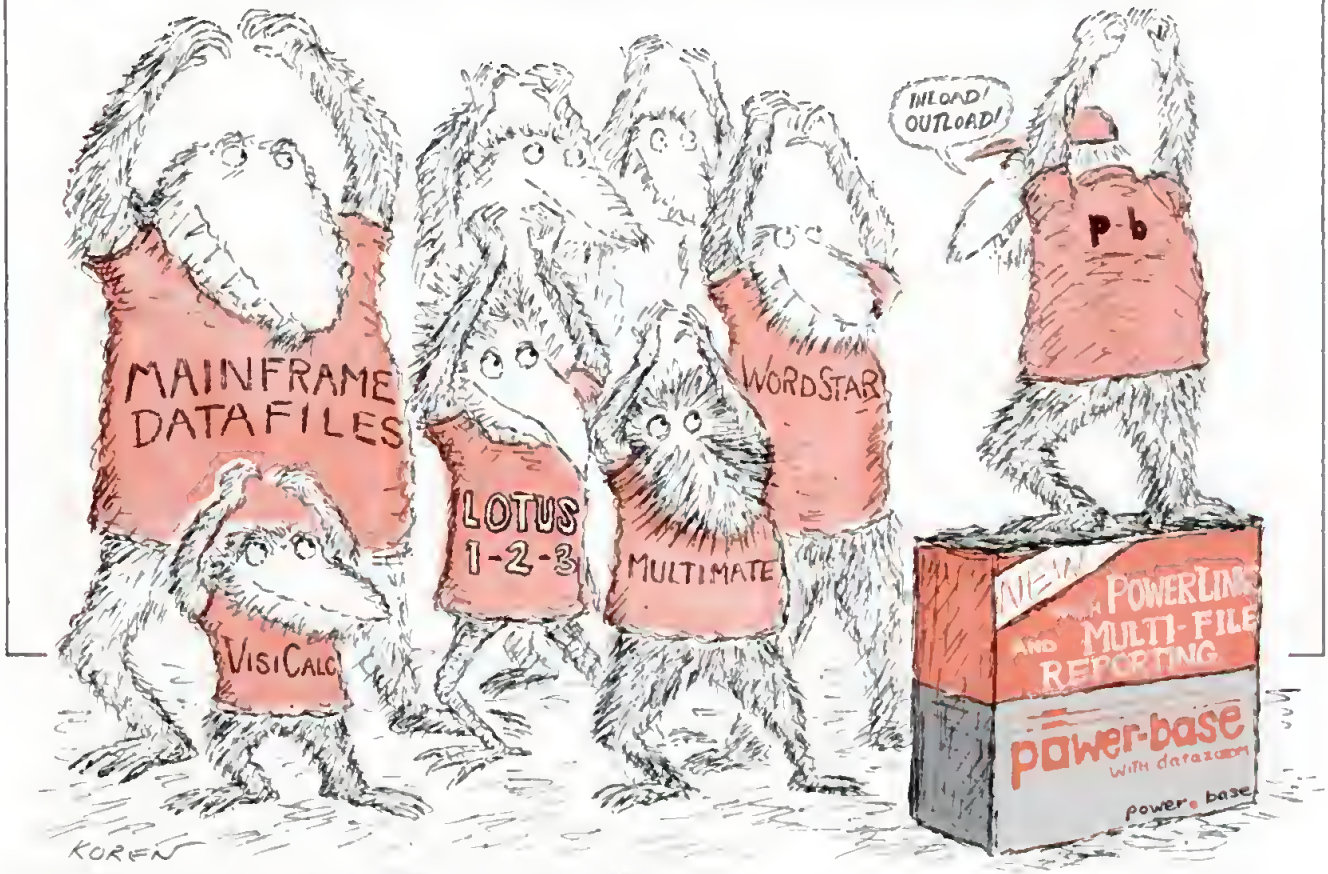

Runs on the IBM PC, PC/XT, PC/AT, and compatibles. Requires 256K with DOS 2.0, 2.1, requires 320K with DOS 3.0

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Here's My Beef

Today's consumers are far more sophisticated than yesterday's. Yet the majority of computer companies don't seem to have the foggiest notion of how to reach them effectively.

I watch TV commercials the way some folks watch the soaps, and sometimes for the very same reason: to shake my head in utter disbelief.

Computer companies don't seem to have the foggiest idea of how to tell us about themselves and their products. Young companies like Apple do grown-up advertising; big, old companies like NEC and NCR do childish things. All of them bombard us with electronic body language and visual cues that have nothing to do with their messages.

Take NCR, for example. One of its ads shows two hip young MBAs visiting their half-built offices in a way that suggests that offices are more important than computers. What does this say to a potential customer?

I like another NCR campaign even less. It's advertising in the Proctor & Gamble style, only with computers "in the kitchen." Dom DeLuise plays an eager small-time salesman peddling the NCR computer to a series of businessmen who make him sweat (they already know its good points and are only teasing him). What an image for NCR: self-congratulatory, patronizing, bullying.

I've watched Wang struggle to find a place for itself on TV with a series of ill-conceived campaigns. The first featured some elaborate, electronic jigsaw offices (high-tech); in the next, a manic drove a desk through office corridors (funny). That campaign was followed by close-ups of people suddenly confronted by computers that appeared on their desks from out of nowhere (user-friendly). The

Paula Green

next spot featured a Wang "singing" Beethoven, in white tie and tails.

This last ad is handsome and classy, but what's it all about? Advertising by analogy. When my husband, an engineer, explained that Wang's integrated system is truly unique—not just a bunch of machines hooked up to the same system or a brilliant, high-tech Rube Goldberg—it made me mad. Why doesn't Wang think we'd understand? It pains my advertising soul when a great product loses becauses it doesn't use its advantages. The customer loses, too, because he or she doesn't have enough information to seriously consider the product.

Some Successes

There are, of course, some successes. Apple's Macintosh ads are wonderful indeed. Not only is the overt message always simple, direct, intelligent, and respectful, but the visuals follow suit. On screen, everything is clean and elegant, with no frilly electronics. Its confidence in us as potential customers gives us confidence in ourselves.

The prime example of style with a message is IBM. Who would have dreamed that Big Blue would have chosen the quintessential little man, Charlie Chaplin, to represent its personal computer? The message—that we can better organize our lives and enjoy the fruits of our labor through the IBM PC—is conveyed through humor. The ads disarm us, conning us into thinking small about IBM. It hasn't humanized just its image, but the whole product.

Take it from IBM: Technology tempered with humanism is the message.

Paula Green is president and creative director of Paula Green Inc. Advertising. Among her successful campaigns are Avis ("We Try Harder") and ILGWU ("Look for the Union Label").

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Letters To PC

Afraid of Prolok Plus

Vault Corporation's *Prolok Plus* distresses me more than just a little ("Copy Protection: A Case of Overkill?" *PC*, Volume 3 Number 23, page 54). What do the software developers who have signed on to copy-protect with *Prolok Plus* expect to gain by using such a vindictive scheme? Do they expect to gain a loyal following when they use this kind of tactic? If so, I hope they'll think again. Software that has the potential to damage my data or my hardware in the name of copy protection is software to avoid.

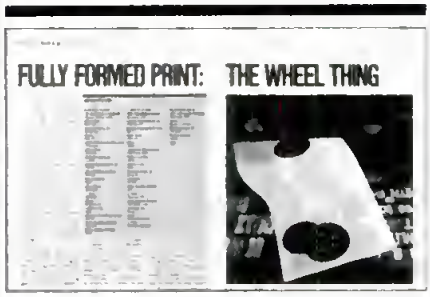
I also don't buy the implication by Vault's chairman, W. Krag Brotby, that there are no accidents and that a user can't use a copy of a *Prolok Plus*–protected diskette by mistake. Does he really believe that? Our small consulting business has been involved in helping church offices use computers. Before they got their computers, many church offices used near-ancient typewriters and other old pieces of equipment. Many of the new computer users in these offices had never even seen a diskette before, let alone know what they were not supposed to do with a copy-protected one. As with any other diskette, they'd probably think they should copy it and use the backup. I believe the potential for mistakes and accidents among new users in particular is very, very high.

Bill Machrone wrote that *PC Magazine* is "clean" ("We're Clean," *PC*, Volume 3 Number 16). He wrote that *PC* won't make copies of software for others, and we also encourage our clients to be just as clean. It feels good to have a clear conscience. I hope software developers using *Prolok Plus* can say their consciences are clear knowing they might damage their customers' data or equipment. If they must copy-protect, try Borland's or RosSoft's approach. Borland charges extra for a non-copy-protected version of their *Sidekick*. RoseSoft simply asks for a signed pledge not to make copies of *ProKey*. I prefer this approach. Otherwise, I wouldn't buy their copy-protected software, and I'd advise others not to buy it as well. I intend to advise others considering *Prolok Plus*–protected software to avoid it like the plague.

Jere C. Batten
Pottstown, Pennsylvania

Problems with Starwriter

Your reviewer's experience while using the C. Itoh Starwriter F10-40 printer illustrates a major problem for any owner of this machine ("Fully Formed Print: The Wheel Thing," *PC*, Volume 3 Number 23, page 310). He can't get



enough correct information to get full value from his highly capable, fairly expensive machine.

I bought my U.S. export model Starwriter and a service manual from a ComputerLand in Tokyo. When questions arose, I asked my wife, who speaks Japanese, to get answers directly from ComputerLand or from C. Itoh. Neither could help us. An engineer at Tokyo Electric (the manufacturer of the printer) helped us to understand the matter of the optional buffer and function chips. For the rest of our problems, we used the method of trial and lots of errors.

Your reviewer was unable to test proportional spacing for right justification, underlining, boldface, and shadow printing, because he was told that they required installation of the optional chips. I have never seen a printwheel for proportional characters for this printer, though the DIP switch settings will allow for it. Also, the *Easy Writer II* program provides all the above features with the Starwriter without installing the optional chips by configuring the printer as Printer A. Unfortunately, *Easy Writer II*'s manual didn't list the necessary codes for this printer, and I had to get them myself. It also provides for bidirectional operation of the printer, even when the DIP switches on the printer are set for unidirectional printing.

Multiplan's printer driver doesn't work very well with this printer. My letters to Microsoft resulted in the suggestion that I look for "some type of buffer overfl. w condition." A better answer, though a little inconvenient, was to print my *Multiplan* sheets through the word processor.

I recognize that *PC Magazine* can't make up for all the omissions and errors made by manufacturers and publishers of software. Thanks for your help in making us aware that there are many errors that we should look out for.

Howard W. Kreiner
Bethesda, Maryland

Look—No Tools

Forget about using two screwdrivers or a sharp knife to open your Compaq case. I would like to share with you my method for opening the Compaq case ("Do It Yourself: Installing a Second Floppy Drive in the Compaq," *PC*, Volume 3

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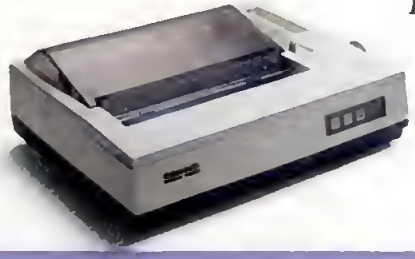

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CIRCLE 102 ON READER SERVICE CARD

LETTERS TO PC

Number 18). The Compaq case opens fairly easily with just your fingers and without the danger of a slip possibly causing $2,000 worth of damage.

To open the case, the first thing you must do is close the keyboard and stand the Compaq upright. Turn the machine so that the panel you want to remove is facing you. I'll call this side the front

side, and the handle is the top.

Now place eight fingertips on the top of the case in a straight line near the middle so that they're resting on the lip surrounding the handle crater. Place both thumbs on the front panel, as far down as you can reach. Imagine that there is a line running from your thumbs to your fingertips and press your thumbs toward your fingers.

A 1/4-inch crack will open between the front panel and the top. Wedge all eight fingers in the opening. Pull up on the top part of the panel until all of the tabs snap free.

Believe me—it's far easier to do than to describe, and I have found that it is safer than using metal tools on a plastic case. It's also the method I've seen used by authorized Compaq repair people in the field.

Edward Fischer
New York, New York

Body Building with PCs

Does anyone know of a software package on the market that is especially used for body building? I don't know of anything that has been done in this market, but I'd like to find more information.

Michael S. Ruiz
Waco, Texas

LETTERS TO PC

Although there are several exercise and fitness programs on the market, there are none that we know of that are specifically for body building. If any readers know of any software, please let us know.—Ed.

dBASE III Distress

We recently received our first 15 *dBASE III* replacements for *dBASE II*. These programs have been eagerly awaited, and we hoped they would relieve the problems we had with *dBASE II*.

Yes, *dBASE III* does run fast. But, in an effort to prevent unauthorized copies from being made, Ashton-Tate made it hard for the program to boot. They have gone so far in copy protection that you can't use the backup system with a hard disk without a reinstallation.

I'm surprised that Ashton-Tate doesn't know that its copy-protection scheme will be broken soon.

I may have found a simple solution to my dilemma. A change to a product that might not have all the bells and whistles of *dBASE III*, but that is easier to use may just end my frustration.

Gene Wingo
Bakersfield, California

Algebraic Equations with 1-2-3

While I was creating a spreadsheet using Lotus's *1-2-3*, I encountered a problem. I was setting up an exhibit illustrating the percentage of actual expenses versus budgeted expenses for each of the branch offices of my company.

I set up the spreadsheet so that Column A represented the actual expenses, Column B represented the budgeted expenses, and Column C represented the percentage difference, which was expressed as the equation $(A - B)/B$. In addition, I wanted to place certain restrictions on the result in Column C. If there were no budgeted expenses (where Column B = 0), I wanted NA to be shown in Column C, rather than ERR. Second, if the magnitude of the percentage difference was greater than 200 percent, I also wanted NA to appear in Column C.

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LETTERS TO PC

I used the following equation, which worked fine, except when $B1 = 0$. In that case, I would get ERR in Column C:

```
@IF(@ISERR((A1-B1)/B1)#OR#
((A1 - B1/B1)>2,@NA, (A1-
B1)/B1)
```

After an hour of algebraic gymnastics, I discovered that the following equation works fine for all situations:

```
@IF(@ISERR((A1-B1)/B1)#OR#
A1>B1*2,@NA, (A1- B1)/B1)
```

Algebraically, both equations are the same. Can anyone help me?

Ed O'Rorke
New York, New York

David Hoffman replies:

The two equations presented here are not algebraically the same by a long shot. However, this is not the problem. If you were to solve for $A1 = 150$ and $B1 = 50$, the statement $(A1 - B1)/B1 > 2$ would be false, while $A1 > B1 * 2$ would be true.

The ERR messages are the result of divide-by-zero errors. Your first equation is on the right track, but you still get an error in the second case of division immediately after #OR#.

There is only one instance of division in the conditional clause of the second equation; hence the illusion that it is equivalent to the first. A correct formula, using nested @IFs, would be

```
@IF(B1=0,@NA,@IF((A1-B1)
/B1>2,@NA, (A1 - B1)/B1))
```

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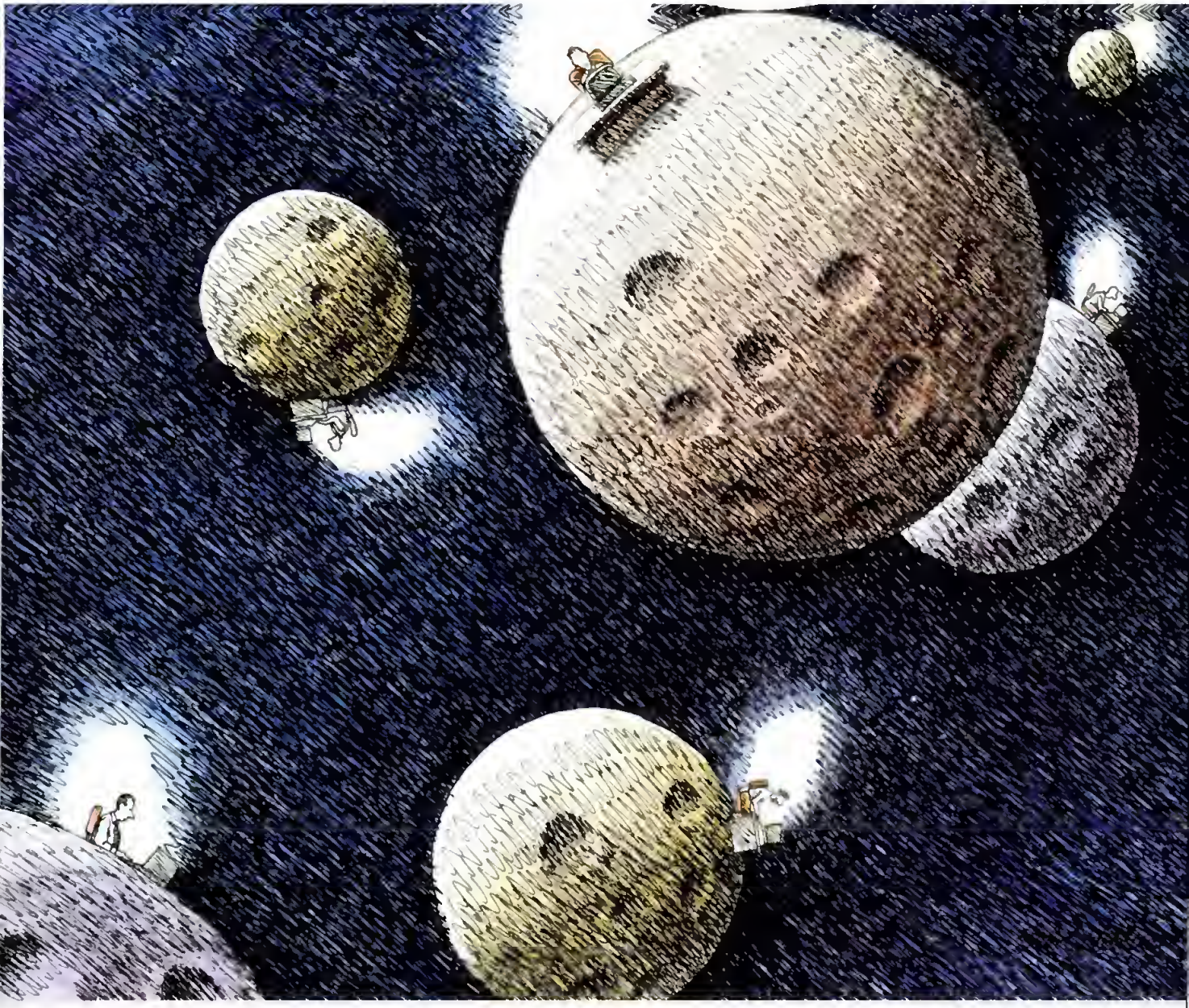

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Screen Drivers and Output

Norton continues his detailed discussion of screen drivers by exploring the use of the PC's BIOS services and the direct-to-screen approach to display screen output.

We've been discussing the interesting problems of writing programs that create their display screen output in a way that's quick, efficient, and snappy and also not completely tied to the quirks of a particular PC model or type of display adapter.

My practical solution is to create three different "screen drivers," three sets of subroutines that do the detailed work of placing information onto the display screen. The programs that generate the display information send it to a sort of master switchboard routine; the switchboard routes the work to whichever screen driver was chosen when the program began working.

One of the three drivers is a very slow performer, but it works on the widest range of computers. This driver uses the so-called ANSI device driver that's been a part of DOS since the appearance of DOS 2.0. By using the ANSI driver, our programs are (reasonably) guaranteed to work on just about any computer that uses DOS, no matter how weirdly incompatible with the PC. The other two drivers are both tied to the characteristics of the PC, and so they will work only on machines that are at least moderately compatible with the PC.

A second driver writes its information straight into the display screen's memory. That makes it a very fast and snappy performer, but it can be used only on machines that are fully hardware compatible with the PC and only in nonwindowing operating environments.

The third screen driver creates its output by using the PC's official BIOS services. This BIOS driver doesn't perform as quickly as the memory driver, but it's much more flexible in the situations it can be used in. Basically, you can use a BIOS driver in any situation that provides software (as opposed to hardware) compatibility with the PC. You might think that that's making a fine distinction, but in practice, it's a very real one. There are plenty of non-IBM computers, such as the TI Professional, that differ from the PC in hardware details but use emulation software to match the PC at the BIOS services level. Likewise, windowing systems such as *TopView* count on programs to use either BIOS or DOS services so that they can be properly "tamed" (brought into the windowing fold in an undisruptive way). *TopView* and some other windowing systems can work with programs that aren't tame and well behaved (say, programs that use a direct-to-memory screen driver) but not nearly as well.

Peter Norton

Previously, we discussed some of the problems and tricks I learned when building and testing an ANSI driver. Now's the time to start discussing those involved in the other two drivers, the BIOS driver and the memory driver.

Although the detailed methods a BIOS driver and a memory driver use are quite different, many of the problems involved are common to both of them.

The first and most important thing that a screen display driver for the PC family has to do is to find out the state of things. This is done with a standard PC BIOS service known as "get current video state"; technically, it's done by invoking the BIOS interrupt services with interrupt 16 (hex 10) and requesting subservice 15 (hex 0F). This service reports the key information we need to know to figure out what we're doing. Most importantly, it gives us the video mode number.

Video Mode Number

Our PCs can work in a variety of video modes—graphics or character; color or black and white; high, medium, or low resolution; and so forth. All these options are reflected in the video mode number, which tells us how our screen drivers should adjust to the computer they are running on.

The original PCs had eight different video modes, numbered 0 through 7; other modes have been added since then. The PC*jr* alone added three new modes. There are many ways to sort through these modes, but for ordinary operation, a program can follow some simple rules to adjust to any video mode.

The first step is to test for video mode, 7 which indicates the computer is using the IBM monochrome display adapter mode. If so, our programs know very simply what they can and can't do. For monochrome video mode 7, all output must be characters—no dot-by-dot graphics (but, of course, using PC's special graphics characters is fine). Also, no color; the choice of display attributes (the monochrome equivalent of color) is limited to bright, underlined, blinking, and reverse video (black characters on a lit-up background). The screen dimensions are a standard 80 columns wide and 25 rows top to bottom. Finally, direct-to-memory output can be done in this mode; the memory address is hex B000 (in the terminology of BASIC, that's DEF SEG &HB000), where the display screen's memory is located. What next? If the mode is under 7, we know we're in one of the modes of the original PC color graphics adapter; in that case, the memory address for direct output to the screen is hex B800, similar to the monochrome address B000. If the mode is over 7, we know that we're in one of the exotic new modes. Either way, we know that we can switch the mode to our preferred choice of color graphics modes. So, once we find we're not in mode 7, we get to set the mode to whatever we want.

Probably our programs will want to force the issue and choose their own preferred mode without regard to the current mode setting. But let's look at what the various modes might be and see how we might adjust to them. If the current mode is 4–6 or 8–10, we're in a graphics mode. (If the mode is above 10, we're in an exotic new mode, mostly likely a graphics mode too.) As things currently are on the PC, a program just can't begin with the computer in a graphics mode—it's always in a character mode; but that will probably change in the future, particularly with the use of windowing systems. If we don't want to be in a graphics mode, we can change it to any of the character modes (modes 0–3, which we'll discuss shortly).

> Our programs need to have some way of learning whether it's okay to fully use color.

If we find ourselves in a graphics mode and don't mind being there, we can still spit out character output for the screen. However, to just throw characters onto the screen in a graphics mode, we have to use the BIOS services, with our BIOS driver; we can't use the direct-to-memory method (unless we want to get into the business of drawing characters dot-by-dot). The graphics modes have two other limitations from our point of view—there is no proper cursor in any graphics mode, and the choice of color attributes is more circumscribed than in the character modes.

Assuming that we either find ourselves in, or choose to put ourselves into, one of the characters modes of the color graphics adapter, what then?

There are four modes to consider, numbered 0 through 3. Modes 0 and 1 are 40-column modes, and 2 and 3 are 80-column modes. Depending on the program we're creating, 40-column mode is either okay or not. If it's not, we just switch to an 80-column mode and hope that the display screen can show 80 columns well.

Color

Next, we get into the interesting ramifications of color. The other mode settings signify if color is active or not. Modes 0 (40 column) and 2 (80 column) are colorless black-and-white modes, and modes 1 and 3 are full-color modes. If our programs find themselves in a black-and-white mode, they should act on it and restrict their use of color attributes (just as our programs should when they find themselves in monochrome mode 7). Bear in mind that there are plenty of PCs that have a color graphics adapter with a display screen attached that can't show colors. This is a popular way to set up a PC, and to accommodate it, our programs need to be able to use or avoid using color in the information they display. However, our programs can't count on the video mode setting to tell them whether or not it's okay to use color.

The DOS command MODE is intended, among other things, to let the computer user set the video mode to colored or colorless. When the mode is set in either of these two ways, any programs that are run afterward can know if it's dandy to use the full color range or not. Unfortunately, relatively few people with one-color displays hooked up to color graphics adapters bother to use the MODE command to inform their programs about it. So, our programs need to have some other way of learning whether or not it's okay to make full use of color. This can be done either by using a program switch on the command line where the program is invoked or by having the program ask the user if color is okay. My programs use the first method, with a program switch called /NOCOLOR.

In the next issue, I'll tell you more about BIOS and memory drivers and also cover some *TopView* tips. ■

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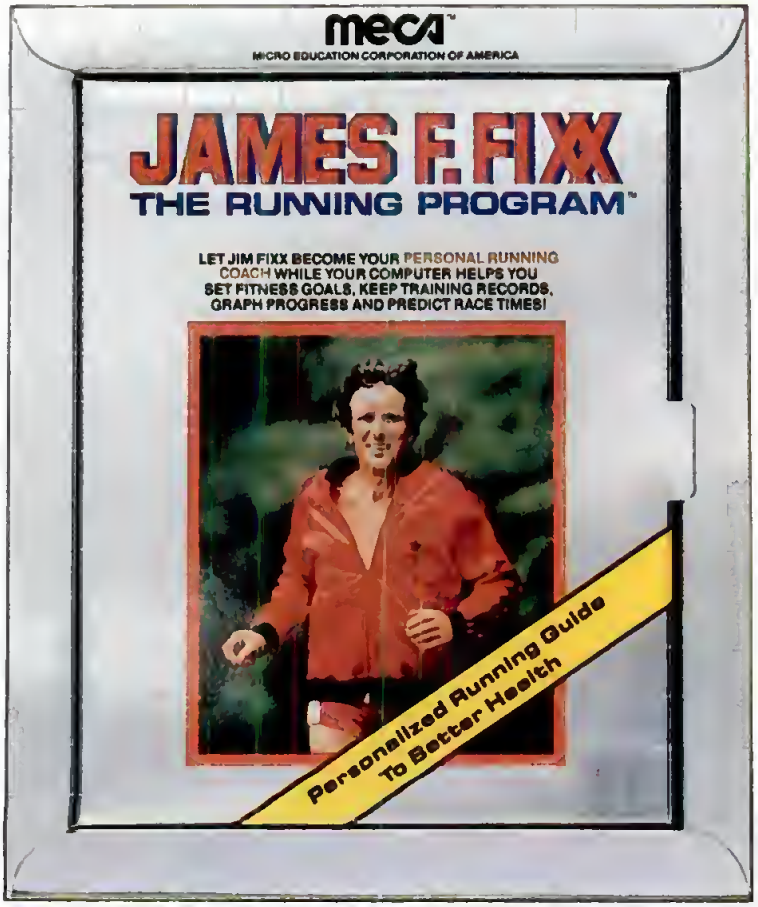

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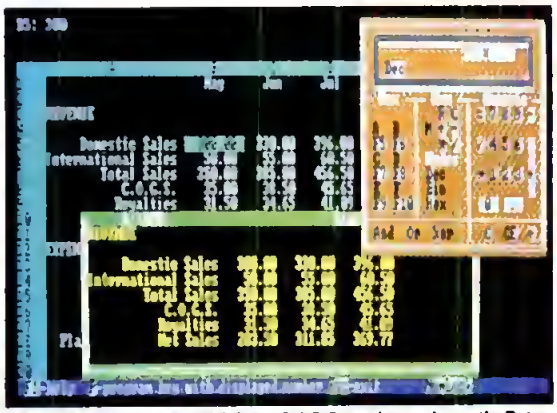

Here's SideKick in action with Lotus® 1-2-3 running underneath. Data has been imported from Lotus to SideKick's **notepad**, shown in the lower portion of the screen. The notepad is a full-screen editor that lets you import and export data; it utilizes WordStar commands to let you time- and date-stamp notes and save them to disk. The SideKick **calculator**, shown at the upper right, offers memory capability, nested parentheses, and the ability to convert decimal to hexadecimal or binary. It even lets you transfer resulting figures to your underlying application.

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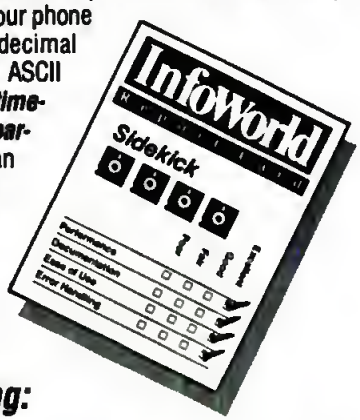
—Dan Robinson of InfoWorld



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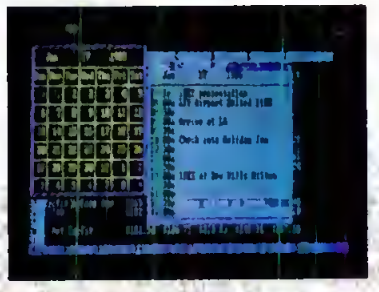
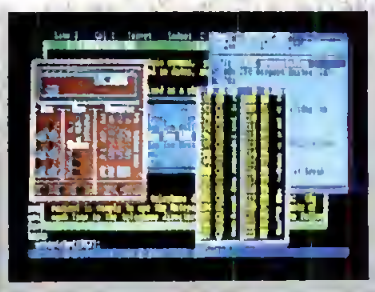
The **telephone autodialer/directory** places calls for you via your Hayes™-compatible modem and locates numbers from one of the program's several directories. Here the dialer is running on top of WordStar.



The **calendar** can record appointments, records and notes—yours or those of the entire department—up to the year 2099. Here the dialer is running on top of Lotus.



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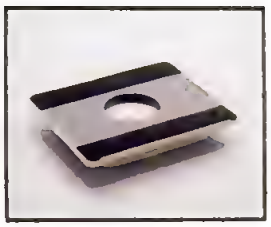

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ONE STEP COMPILE (NO LINKING NECESSARY)	NO	YES	YES
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(*) **Benchmark** run on an IBM PC using MS Pascal version 3.2 and the DOS linker version 2.6. The 179 line program used is the "Gauss-Seidel" program out of Alan R. Miller's book: *Pascal programs for scientists and engineers* (Sybex, page 128) with a 3 dimensional non-singular matrix and a relaxation coefficient of 1.0.

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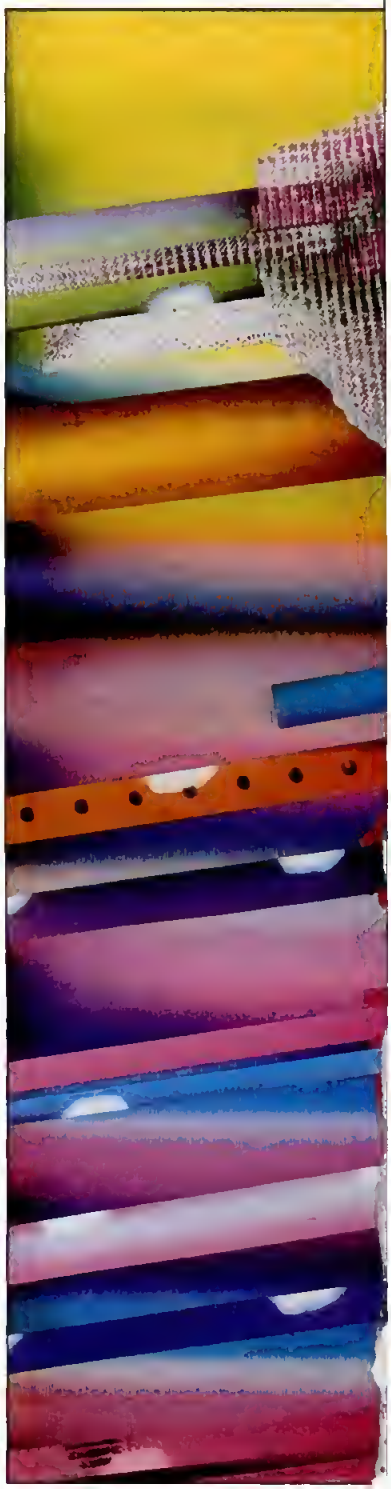
WITH THE AID OF SPECIAL SOFTWARE AND HARDWARE, YOUR PC can now recognize speech, store it in digital form, and display it on the screen. Going the other way, it can synthesize a human voice, converting digitally stored sounds and words into wavelengths vocalized through the PC's speaker. ■ These two-way technologies permit telephone message systems and voice mail to use messages stored on disk to replace real humans. A talking and hearing PC can help lighten the burden for the handicapped, and kits are available for hobbyists to use voice commands to control household appliances. ■ PCs that speak and listen can even talk to your dog, giving a new meaning to "his master's voice."

PERSONAL COMPUTERS SPEAK FOR THEMSELVES

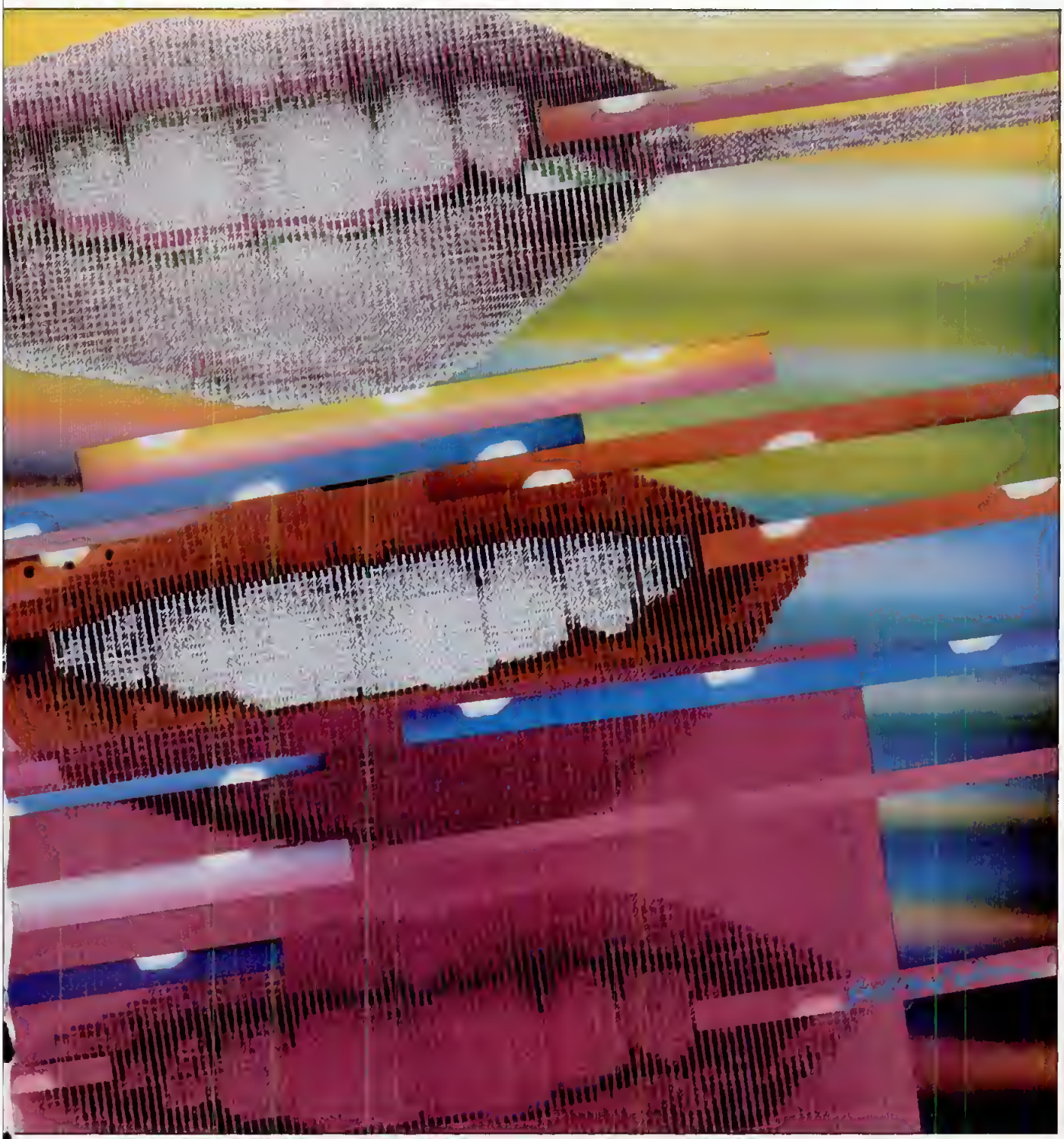
Photograph: Dennis Chalkin

MAINFRAME TECHNOLOGY AND NEW HARDWARE FROM TECMAR AND VYNET ARE MAKING THE POTENTIAL USES OF SPEECH SYNTHESIS THE TALK OF THE TOWN.

The Voice of the '80s



CONVERSING WITH COMPUTERS has been a common fantasy since the machines were invented. Typically, users pictured themselves engaged in friendly banter with mechanized alter egos. Today, thanks to the state of voice synthesis technology, many speech-related applications go beyond cocktail conversation with a pile of chips. These applications range from the whimsey of Dial-a-Joke to the seriousness of bringing computer power to the visually impaired.



Some systems create humanlike speech out of bits not input from a microphone. Others build speech from computer-generated sounds or phonemes. Or a programmer might put voice elements together to form words.

Illustration: Jeffrey Schrier

Getting machines to understand human speech is the business of speech recognition. Enabling humans to understand machine speech is the business of speech synthesis.

This article explores the technology of computer-related speech synthesis. Bear in mind, however, that the lines between synthesis and recognition are at times very fine, especially when both speech synthesis and speech recognition systems are on a single board.

STARTING WITH EDISON

Reproducing the human voice is a relatively simple process. Thomas Edison did it with his phonograph, as did Alexander Graham Bell with the telephone. In both cases, the trick was getting a diaphragm to vibrate properly so that sound waves could be generated through a medium such as air with as much fidelity as possible.

Edison recorded speech (and other sound) for on-demand recall. He did this by attaching a needle to a diaphragm and then placing this needle against a rotating cylinder coated with beeswax. As the needle tracked along the cylinder, it etched a patterned groove in the beeswax. During silent periods, the needle etched a straight and smooth groove. However, when the operator yelled into the diaphragm, the diaphragm was set in motion, and the needle responded by producing a "modulated" line in the beeswax.

In the digitizing process, the system samples the voice qualities of the incoming audio signal and stores the results digitally.

Later, when the needle was allowed to track in the previously "recorded" groove, the diaphragm vibrated as it passed the modulated sections of beeswax. The new vibration was identical to the vibration during recording, and thus the original sound was reproduced.

As for the computer, its diaphragm, the speaker unit, is set in motion by vibrations that will produce air pressure patterns recognizable as speech.

The beeswax recording's speech is represented as an analog or continuous curve. The digital speech synthesis's basic voice information is stored in digits. However, if enough digits (or bits) are used, the information can approximate an analog or continuous curve.

DIGITIZED SPEECH

Digitization points to the easiest-to-understand speech synthesis method, the straight digital recording. (You may have noticed that some popular stereo and quad records are recorded with digital techniques.) Speech (or other sounds) are collected by a microphone and then digitized for storage on some kind of medium—Mylar tape, plastic record, floppy disk, or prom.

In the digitizing process, the system samples the pitch and amplitude (and other voice qualities) of the incoming audio signal and stores the results digitally. The higher the sample rate, the better (higher fidelity) the recording. Getting a voice quality that is both understandable and recognizable (like recognizing Mom's voice over a long-distance telephone line) requires that the voice be sampled about 8,000 times per second. Since the information recorded at each sample can be stored in 8 bytes, about 64K bytes are needed to store a single word using this technique.

To avoid running out of storage (core and disk)—which is very likely at the rate of 64K bytes per second of conversation—audio engineers developed different speech synthesis methods in order to reduce memory requirements (and thus cost per word) while retaining as much fidelity as possible.

One concept at the core of several proprietary methods involves stripping the incoming word of everything except its absolute meaning and then fleshing it out during output. For example, when you speak the word *automobile*, your voice forms the word with tonality, pitch, and timbre, and perhaps a regional accent. In this type of synthesis, all stylistic elements are removed so that only the raw informa-

PC TARGET DISC

V101/102 Series
VYNET Corporation
2607 S. Winchester Blvd.
Campbell, CA 95008
(800) 538-7002, (408) 370-9764 in California, (408) 349-0600 for demonstration
List Price: $695 to $1,995
Requires: Microphone and preamplifier for V101/102I/SD/SP; hard disk recommended.

CIRCLE 676 ON READER SERVICE CARD

Speech Master
Tecmar, Inc.
6625 Cochran Rd.
Solon, OH 44139-3377
(216) 349-0600
List Price: $395, board; $100, software
Requires: 64K RAM, one disk drive, DOS 2.0 or later.

CIRCLE 674 ON READER SERVICE CARD

tion contained in the word is left. Later, when the applications program needs the word, it uses mathematical voice models (algorithms) to put back timbre, accent, and other such elements. These schemes can reduce storage requirements from 64K to between 8 and 10 K hytes per second.

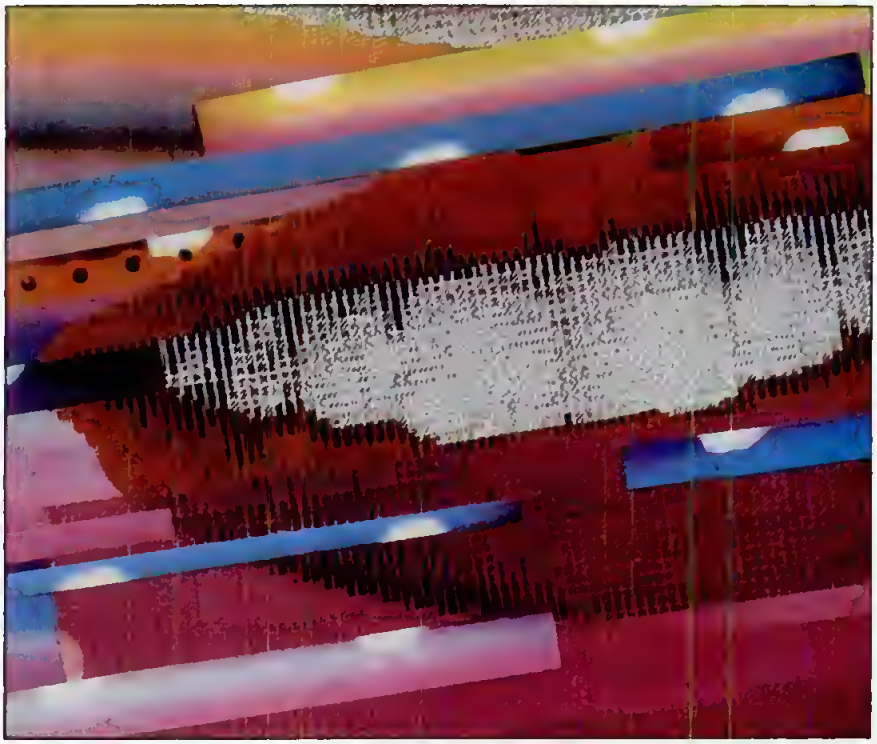
The shaping algorithms are the key. You can think of them, for simplicity's sake, as models (analogs) of standard speech patterns. When the analog receives a skeletonized word as input, it makes an educated guess as to how to reform its structure into an understandable word.

So far, I have discussed only the storage and the recall of human-originated speech. However, some schemes create humanlike speech out of raw hits rather than input from a microphone. Some companies, such as Texas International, have huilt humanlike speech from computer-generated sounds or phonemes. The voice engineer creates a skeleton of the desired word and stores it on a ROM chip. Later, when the applications program needs the word, it is fleshed out with voice models.

Yet another approach is to let the applications programmer rather than the chipmaker put voice elements together to form words. (See this issue's section on Tecmar's Speech Master.) In this way, the programmer builds words from phonemes contained on chips using whatever extraneous information he wishes. The computer can speak in a Western drawl if desired and, of course, you can create your own special vocabulary.

SAVING LIVES WITH VOICE I/O

Experimenting with the various boards convinced me that voice I/O is not only fun hut has many practical applications as well. Many computer-controlled manufacturing processes demand that the operator split his or her attention between a CRT and the actual process. Whereas a bell could signal the user that attention should be directed to the CRT, consider how much more helpful it would be if the audihle warning contained information about exactly what is going on. For example, "temperature on Oven 10 is exceeding limits" gives much more useful information than a "gong" sound. This particular technique has been used for years in aircraft cockpits to anounce emergency situations to the crew. The seconds saved have spared uncounted lives.



All the boards discussed below can be used without a full understanding of the technology behind them, and programmers with moderate experience can use them all (the Tecmar board can even be used hy nonprogrammers).

The designers of these boards differ in their approaches to speech synthesis hut agree that the proliferation of the IBM PC standard has paid for the R&D necessary to bring a highly sophisticated mainframe application into the micro world.

The designers also agree that voice technology is going to sneak up on us. Soon, all applications programmers will be asking themselves if sound is appropriate for their applications because speech I/O will be cheap enough to enhance an application without making it prohibitively expensive.

TECMAR SPEECH MASTER

Tecmar's Speech Master comprises a single, multilayered, 13-inch board that fits into any PC expansion slot. On the board are a 1½-inch-high speaker, a Votrax SC-01 Speech Synthesizer, a National Semiconductor "DigiTalker" LSI chip, two ROM vocabulary chips, and miscellaneous control circuitry (buffers, amplifiers, and mixers).

Installation takes less than 10 minutes. First, you check the default I/O ports and interrupts to be sure they're clear. Then, assuming they are, you plug the board into an expansion slot and screw it down. If you have to change the port or interrupt addresses to avoid conflict with other installed devices, you need only set the new addresses on the board's two digiswitches, and you're in business.

The on-board inch-and-a-half speaker is adequate for developmental work (assuming you have super hearing). I recommend, however, that you take the time to

install a jumper that cuts out the on-board speaker and routes audio out of port to an externally mounted RCA jack. This jack can handle a 16-ohm (portable radio type) speaker or a full-blown speaker-preamp combination. This extra step adds only 3 minutes to the installation process.

Now with the hardware down, you and your computer are ready to enter the computer talkie age.

Tecmar offers a $95 software package called Speech Master Software Support. Don't leave the shop without it. This package opens the door to both the Digitalker and the Speech Synthesizer and gets your system talking in minutes.

SPEAKING IN PHONEMES

This Tecmar board employs two types of computer speech generation—phoneme generation, in which words (and other interesting sounds) are built up of component parts (phonemes), and vocabulary synthesis, in which speech is generated by software selection from a 143-word ROM-based vocabulary.

The 143 words contained in the Digitalker ROM include the numbers 0 through 20, the cardinals in steps of 10, and the terms *hundred, thousand,* and *million.* The vocabulary also contains the alphabet, operators (mathematical, relational, and logical), metric prefixes and suffixes, and a collection of control words such as *on, off, start,* and *stop.*

While this vocabulary was designed for industrial control and warning applications, it is also sufficient for many pure computing applications, such as monitoring input into a spreadsheet.

The board uses four consecutive I/O locations. To generate speech or process control responses, you have to program writes and reads to those I/O locations. For example, each of the 143 vocabulary words has a hex code. Writing a code to location 0 sets the next word to be spoken. A read at location 3 returns the "done" status on bit 7.

Those users who are not fond of assemblylike programming are saved by the software support package mentioned earlier. This package includes a text-to-speech DOS overlay package called English and a talking terminal program (DOS 1.1 only) called Speak. The package also contains a half-dozen truly excellent demo programs.

Half the fun of experimenting with the Speech Master board is playing with phonetic spellings.

English is a driver program that includes a sophisticated text-to-speech algorithm, which uses the phoneme generator, and a routine that allows text to be input by means of BASIC's LPRINT statement. An example would be:

```
10 C$ = CHR$(255)
20 LPRINT C$ + "This will be
   spoken"
30 LPRINT "This has no prefix
   code and will be printed"
40 LPRINT C$+"This will be
   spoken again."
```

In other words, each LPRINT statement that begins with an ASCII 255 will be spoken. The absence of the ASCII 255 control character prefix implies that the object string is to be routed to the printer instead.

The text-to-speech algorithm applies a set of rules to a given word so that a sequence of phonemes will be produced that, when spoken by the speech synthesizer, will most accurately correspond to the input text. Sometimes the usual English spelling produces a perfect sounding word. At other times, you may want to spell the word phonetically to get the best results.

For example, the word *see,* as in "see the cat run," comes out just fine. However, the word *photo,* as in picture, sounds better if it is spelled "foto" in the LPRINT C$ statement.

FOOLING AROUND WITH PHONETICS

Playing with phonetic spellings is half the fun of experimenting with the Speech Master board. Not only can you use phonetic spelling to produce American-English–sounding words, but you can also use phonetic speech to give your computer an accent—perhaps a staccato German-sounding English, or maybe a more melodic French tonality.

The board also has some more serious applications. Imagine, for example, adding speech to learning programs you've written for your toddler, or enabling your computer to inform you of the status of a processing job verbally while your visual attention is elsewhere. Because any "LPRINT C$ + (string)" will be spoken, you can make your own BASIC programs as chatty as you want.

One of the Tecmar demo programs is a simple BASIC routine that speaks any line input to the screen through the voice port. This is a valuable utility to perfect the phonetic spelling of a phrase before it is put into your applications program.

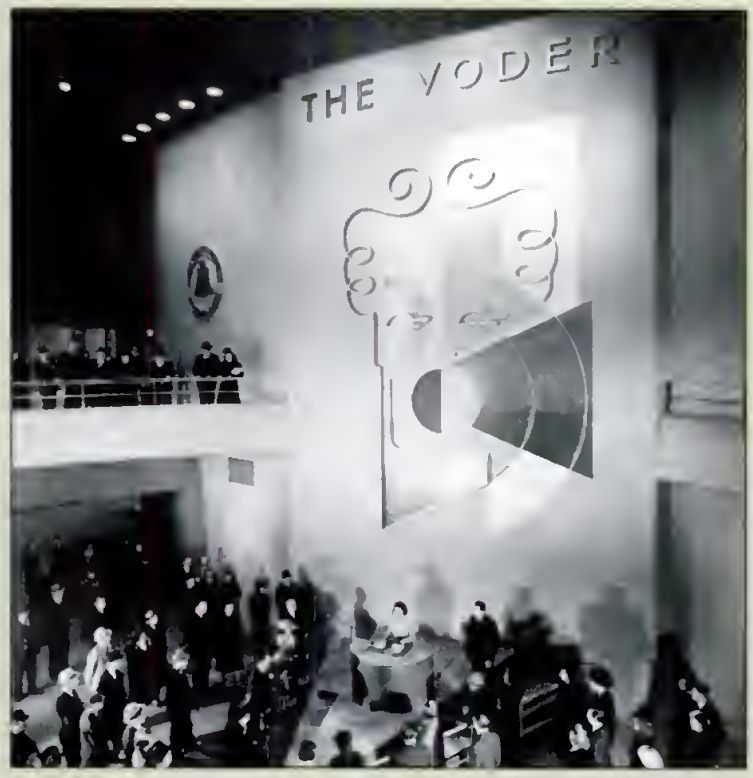
Another demo program, FILEREADER, would be of particular value to the partially sighted, especially when combined with the Talking Terminal program SPEAK. This program will read any ASCII text file word for word, line for line (this article, for example), and speak the results.

SPEAK is a delightful program that

In the Beginning, Thus Spoke the Voder

Before the chip was even invented, the Voder was synthesizing speech, attracting crowds, and making headlines.

Speech synthesis is not new. In 1936 Bell Labs built a speech synthesizer. Three years later it was exhibited in New York at the World's Fair. The device looked something like an organ. It had a keyboard, various pedals, switches, and dials, a box containing the energy sources (the vacuum tubes and amplifiers), and three loudspeakers. A trained operator sat down and "played" its keys, much the way someone would play an organ. Except for some difficulty with the letter *l*, the machine could produce just about any word or sound imaginable. The audience was amazed.



The machine was called the Voder, for Voice Operation Demonstrator. It was not built for any particular practical application but was instead a showpiece to demonstrate Bell Telephone's technical superiority. In the AT&T pavillion, it was strategically placed next to a long-distance telephone communication exhibit. The Voder drew huge crowds and made the headlines.

In addition to the human voice, this primitive speech synthesizer could imitate animal noises, airplane engines, in fact, any type of sound requested. However, the Voder could do nothing without its operator, who used her fingers on the keyboard to produce the required combinations of sounds, her feet on the control pedals to monitor volume and pitch, and her elbow to push a switch to reconnect the keys to different oscillators' sound-producing tubes.

Today's voice synthesizers produce words by a variety of means: Words can be taught to a machine by the user constantly repeating them; they can be preprogrammed into a computer's speech synthesis board by the manufacturer; or the user can combine phonemes (sounds that have been preprogrammed into the computer) into combinations of words or sentences.

This last process is closest to the Voder's method of sound production. The Voder used two electric oscillators, one to produce vowel-type sounds, the other to produce consonant-type sounds. Pressing a key activated a particular sound filter, used with one of the oscillators to produce the desired vowel or consonant sound. Proceeding in this way, the operator could string together words and sentences.

Voder's operator had to do a lot of switching. Not only did she have to switch between different sets of electric tubes to produce different types of oscillations for vowels and for consonants, she also had to switch back and forth between spoken and whispered sounds, and between open consonants like *s* and *v* and closed or "stop" consonants like *k* and *t*. Considering that the operator of the Voder required 1½ years of training to become competent, today's speech synthesizers seem much more efficient in terms of time and energy.

Still, the Voder was remarkable. It could perform just about any task imaginable, from reciting "Mary Had a Little Lamb" with a German accent, to imitating a complete repertoire of barnyard noises. Any sound you asked it to produce, the Voder would oblige, thanks to the amazing powers of the human brain housed in its operator. In its own way, the Voder was a virtually limitless speech synthesizer.—**Roz Tobias**

speaks both output from the CPU or that which is typed in from the keyboard. Depending on function key selection, it will speak what appears on the screen character for character, word for word, or line for line. You can also direct *SPEAK* to read any line on the screen. Unfortunately, *SPEAK* runs only on DOS 1.1 or 1.85 (a user-patched version popular on the BBS systems). However, Tecmar does have a rewrite for later DOS versions in the works.

Documentation for both the board and the software is well written and concise and includes everything necessary to get the board up and running programs in minutes.

The Tecmar Speech Master is all that its manufacturer claims, and more. If you want to experiment with speech synthesis, start with this board.

THE VYNET V102I/SD/SP AND V102I/VS

Bank-by-phone and similar voice/phone/Touch-Tone schemes are what VYNET and its products are all about.

If you haven't run into a bank-by-phone system, here's how it works. You call a special phone number (usually an 800 number) using either your Touch-Tone phone or pulse phone with a Touch-Tone generator.

A digitized voice answers something like this: "Hello, this is your Booneville Last National Bank-by-Phone Service. Please enter your account number."

You dutifully punch in your checking account number using the Touch-Tone buttons and end the entry by hitting the number sign key.

The voice confirms your account number and tells you to enter your personal identification number. You then punch in your secret pass number.

If you do so correctly, the voice says, "Thank you. Please enter merchant's number or transaction code."

This banter continues until the transaction is complete. With this system, you can use various codes to make payments on credit-card accounts, transfer funds from one account to another, or simply verify your checking and savings account balances.

Basically, you are "talking" to the machine by pressing buttons on your Touch-Tone phone. The machine talks to you using a digitized (but remarkably human) voice. Since information moves in both directions, true communication exists.

VYNET is one of a small number of companies that specializes in this type of man-machine-man communication and has highly sophisticated boards (V101/102 Series) designed to let the PC and its lookalikes in on the action.

VYNET's dual-channel board synthesizes digitized speech with recordinglike fidelity.

SOPHISTICATED DICTION

The top of the VYNET line is the V102I/SD/SP, a dual-channel board. It can monitor two phone lines simultaneously, each with its own program. In addition, it can digitize and play back speech (which is what the SD and SP in its name refer to). Finally, this board uses adaptive differential pulse code modulation (ADPCM), a technique that synthesizes digitized speech with recordinglike fidelity.

If you don't want to invest in such a top-of-the-line model, you can use single-channel playback and synthesizing units, which use linear predictive coding (LPC), a less expensive voice technique. However, such a technique also produces a less humanlike voice quality.

For this article I reviewed two top-of-the-line products—the V102I/VS interactive telephone voice response unit and the V102I/SD/SP telephone speech digitizer and playback unit.

Installing the VYNET boards is straightforward. First the user makes sure the default ports and interrupt do not conflict with other installed devices. (If a conflict exists, digiswitches and pin jumpers can be used to change both the port address and the interrupt.)

The units reviewed here have multilayered boards and both piggybacked and underslung auxiliary boards. Each board takes a boardsworth of interior space. The fit is tight, however; you may have to switch boards around if you have other boards populated with tall chips or piggybacked boards.

RJ11 telephone jacks (identical to modular wall plugs) are located on the back mounting panel and are attached directly to the wall lines. No modem is needed because VYNET boards contain the FCC-approved modem circuits needed for the voice-out, Touch-Tone-in connection.

A toggle switch is also located on the back mounting panel. This switch allows you to monitor either channel (over an external speaker) for incoming and outgoing information. An RCA jack, also located on the mounting panel, handles audio output to the monitor. (A second RCA jack is available for a microphone for speech recording and other low-power audio input.) After installing the VYNET boards, you load the drivers from the software disks VYNET supplies, and all systems are go, or at least you're ready to develop your applications program.

The driver routines, which can be accessed through calls from most high-level languages, including BASIC, Pascal, FORTRAN, and C, are at the heart of the VYNET system.

The routines, of which there are 27, control the communications and speech hardware. These routines might include such commands as "take phone off hook," "wait for ring," "wait for received tone," and "output a speech phrase."

Other routines decode input for program and communications control.

A TYPICAL APPLICATION

In a typical application, the programmer determines what information the system is to retrieve and then chooses words or phrases the VYNET board will use to communicate information and commands to the person on the other end of the line.

Next, the user digitizes and edits these phrases, thus creating a phrase file and index file for the drivers to use (through commands from the applications program).

You must supply an audio input device, consisting of a microphone and preamp, for phrase-file development. (While not absolutely necessary, the preamp does help make speech more humanlike.)

This leads to the actual creation of speech. To start, you speak the selected words, phrases, and sentences (or piece of music) into the microphone while running VYNET's DIGITIZE utility. DIGITIZE allows you to review what is input and to reinput what you want changed. This brings us to the adaptive differential pulse code modulation (ADPCM) technique.

If you wanted to digitize 1 second of human speech with reasonably high fidelity—the word *hello* for example—you would have to sample the word about 8,000 times while recording it. As I mentioned earlier, the data sample would require 8 bits of storage or about 64K. Obviously, this would place prohibitively large memory requirements on a microcomputer system.

ADPCM techniques reduce a 64K-bytes-per-second storage requirement to about 4K bytes per second.

FEWER BYTES TO MORE STORAGE

ADPCM techniques reduce that 64K-per-second storage requirement to about 4K bytes per second by stripping the word down to raw intelligence for storage, then fleshing it out again for output. (How this is accomplished is too involved to go into here.) The scheme produces and reproduces phrases with a remarkably humanlike quality quite dissimilar from the commonly perceived "that-does-not-compute" lost-in-space style of computer speech.

Once the phrase file is complete, the VYNET functions can output phrases as dictated by the applications program. You can move any amount of data in either direction.

ADPCM techniques are used on the higher-priced board for applications, such as automatic bank telling, that require more humanlike speech. LPC techniques, similar but not as high in fidelity, are used where the voice does not have to be quite as perfect—in control. applications, for example.

In still other situations, you can employ techniques that use a fixed vocabulary provided by the chip vendor. One lower-priced board, for example, includes a 1,300-word vocabulary that includes just about anything you could want in process control, aviation, and meteorology. Again, some fidelity is lost, but it is not necessary in these applications.

For our tests, we used a slightly modified demo package that called various *PC* magazine editors and asked for their phone numbers. In some cases, the VYNET board initiated the call, and in other cases, the *PC* editor initiated the call. All our tests revealed the voices to be "peoplelike rather than robotlike." In all cases, the data input by Touch-Tone was faithfully received.

The applications for this technology are limited only by the number of situations in which machines and people have to communicate over phone lines. Imagine for a moment a chemist working on an experiment in which a particular solution's temperature must remain constant. The chemist could write a simple program that would monitor the temperature of the solution and call him at home every 2 hours with the result. Or, if he wanted to give the computer a full assistantship, he could hook up a pot to the lab heater and control the temperature by inputting Touch-Tone commands in response to the verbal report from the VYNET board.

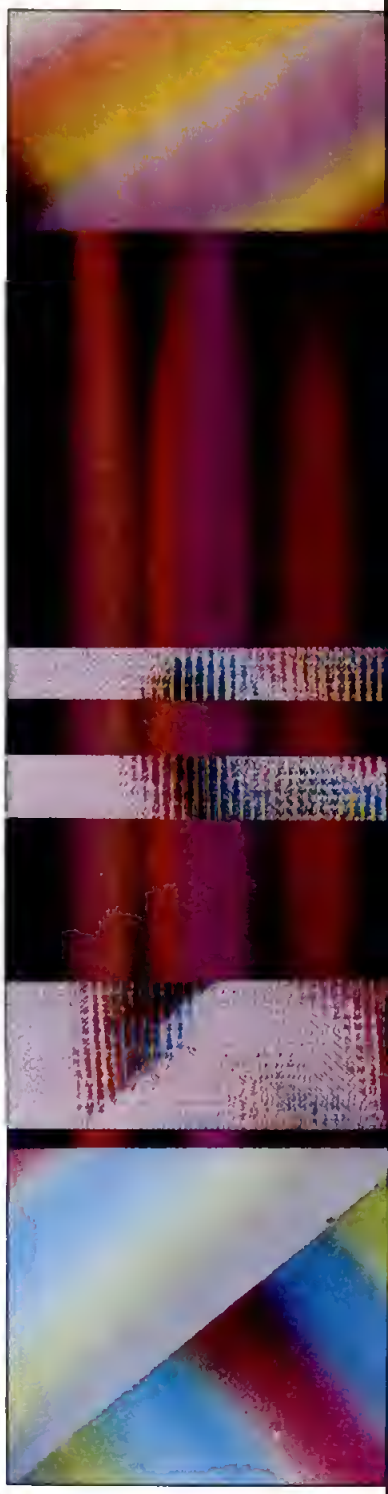
Using digitized voice synthesis for banking, marketing, and polling applications is fairly common. Database query response is also a natural. Consider a brokerage house customer who wants to check the value of a stock. If the firm had a digitized system, he could call up, enter his account number, and touch in the three-letter Big Board code. The voice would then check the ticker line and sound off the latest quotes and volumes.

If these applications are the types you will be using, VYNET is the place to start. If the company doesn't have the precise board you want, it will either make it to your specifications or tell you the best way to use applications programming.

The VYNET products are, in my opinion, solid, and the enthusiasm of the company's technical staff is a special plus to first-time users of this technology. ■

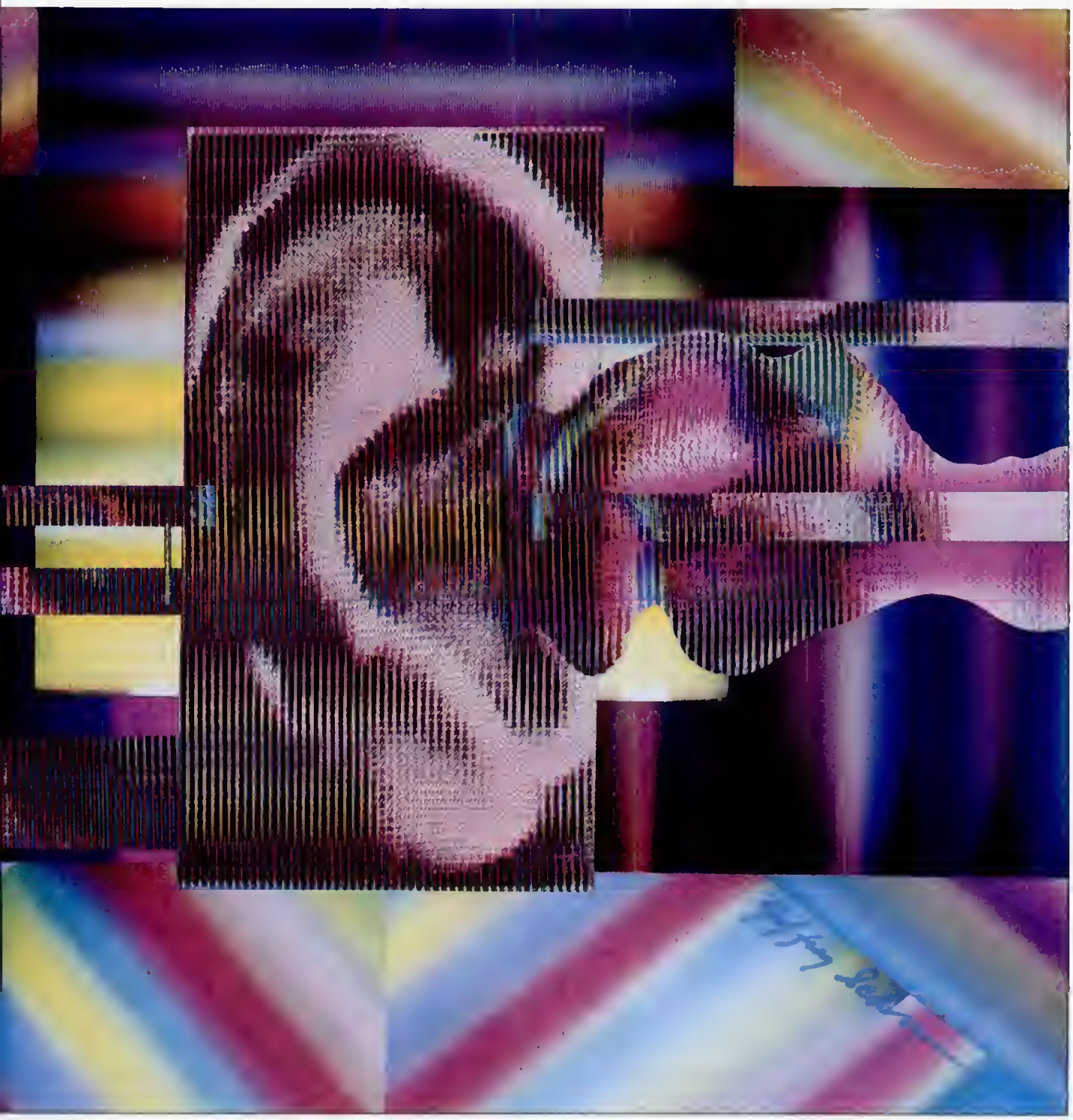
WITH PC SPEECH RECOGNITION, YOU BYPASS THE KEYBOARD AND CREATE VOCAL COMMANDS THAT CAN BE USED WITH MOST PC SOFTWARE. FIVE SPEECH RECOGNITION BOARDS ARE REVIEWED HERE.

When You Talk, Your PC Listens



AS COMPUTERS ASSUME MORE JOBS that once required human skills and effort, some people find themselves endowing the machine with human characteristics. But it's not surprising, since Hollywood has shown us talking robots for years, and the modern android is a star.

Real-life smart machines have now begun



PC speech recognition systems use spectral analysis, sampling of sound at specific frequencies, to take the audio frequency waveform of a spoken word and convert it into a digital template.

Illustration: Jeffrey Schaler

to mimic humans: Supermarket cash registers announce your groceries as they're rung up and tell you how much the items cost; your car reminds you that your tank is low or that the door is not shut tightly.

So it's only natural, in panic or frustration, to address a smart machine directly, swearing or pleading, according to the situation. Everyone knows machines can't hear. Or can they?

Computer speech recognition, on the drawing board for more than a decade and available for limited applications on large computers for several years, has recently been adapted for use on the PC. Though speech recognition technology lets you speak only limited commands to the PC, it is still early in its development cycle. Of the four speech boards I reviewed, the makers of three of them were just putting the finishing touches on their manuals and debugging software. Another half dozen say they'll have a product to ship in a few months.

FREED FROM THE KEYBOARD

Speech recognition has been used most often where it is inconvenient or impossible to use a keyboard to give information to the computer. Commercial applications such as quality control in factories use speech recognition where the operator is busy inspecting parts and works much more quickly when freed from the keyboard. From inventory control at a loading dock to electronic videotape editing, speech recognition has been used in a variety of tasks that keep the hands busy.

But potential uses are not limited to large-scale commercial applications. Handicapped users are another obvious market. A variety of applications involve interaction by telephone from remote locations that lack a keyboard. Voice messaging and voice database applications are also possible with speech recognition technology. Most of these applications, however, have been limited by the cost of the large-scale hardware needed to operate such a system.

It's only natural, in panic or frustration, to address a smart machine directly. Everyone knows machines can't hear. Or can they?

Many PC speech recognition boards appeared at roughly the same time. First, the types of chips used for speech recognition were in short supply until recently. Mostly, however, the popular PC has become a magnet for a wide variety of computer technologies and engineering efforts, including speech recognition. Rapid development will continue as companies in the field work to refine and enhance the software.

Each PC speech recognition board offers different features, but the basic technology is roughly the same (see sidebar, "How Speech Recognition Works"). Each board uses a software package that includes a driver and a utilities package. The driver works like an operating system, to link the speech board to the rest of the PC. You use the utilities program to create, edit, and store the command vocabulary. You can use the set of commands with almost any IBM PC software available.

Some manufacturers also include software for program developers and serious hackers, which can be used to incorporate speech routines directly in applications software. The current generation, however, is limited to the so-called speaker-dependent variety; this means that a specially "trained" template file must be created on the PC for each user's voice. This file is a list of voice prints, or templates, for each voice command you want to use, in place of the keyboard, to run a particular program. And, just as you may be mistaken for a close family member on the phone, these speech recognition boards can be fooled by speakers with similar speech patterns.

STRUCTURING VOCABULARY

The typical routine for setting up the speech device begins before you install the board. First, decide how you want to set up the voice-input routine; then select the words for your vocabulary. These two important steps can save you many long hours later.

Because the voice-input routines must rely on one- or two-word commands, the versatility of a routine depends heavily on how it is organized. Can you reduce your work to a series of menulike questions, each of which takes a handful of responses? Or do you need some commands available at all points in the session? By properly structuring your speech vocabulary, you can save time, memory space, and frustration when you use the voice commands with your program.

The word-selection process also is critical. The recognition system's main job is to sort out spoken words and to act on these separate commands. There are several ways to fine-tune a speech recognition routine that is not performing reliably.

Just as in human conversation, speech recognition has plenty of opportunity for misunderstanding. For the best voice input, avoid words that sound too similar. Short single-syllable words can wreak chaos in your routines. For example, if you are using the word *one* and also need the word *up*, try using *up* in a phrase such as *page up* or *scroll up*. If you're already using *off*, don't use *car*, use *automobile*. Some similarities are unavoidable, but

keeping the words separate pays off. (For some reason the word *four* is extremely difficult for all the boards I reviewed, but obviously there's no easy substitute.)

Once you've chosen your vocabulary and matched up the keyboard characters, you're ready to start. After you load the list of commands and keystrokes, the computer prompts you to speak the commands into a microphone, "training" the computer to understand your voice. It may run through the list several times if you tend to change the pitch of your voice or pronounce the words differently: it's looking for a consistent sample to rely on.

The template file is saved to disk, and so you can create and train different vocabularies for several programs or several users of the same program. (Because these boards are speaker dependent, no one else will be able to use your template file.)

Though it's hard to describe the potential power of voice commands, the effect is most dramatic on programs slowed by keyboard input. Microsoft's *Flight Simulator,* for example, is an impressive program that suffers from inadequate controls: Most private pilots find the graphics and flight characteristics realistic, but complain of the lack of response from keystrokes. The VocaLink board came with a prewritten, 100-word vocabulary for the program, which can be run entirely by voice command. The VocaLink system also "talks back" through a speech synthesizer, providing interactive routines. The command "throttle," for example, brings the synthesized response "set throttle," and you instruct it from there ("full," "half," "cut two," and so on). If you ask for a different cockpit view to change the graphics display, the system asks "which way?" to which you reply, "left," "right," "front," and so on.

Unfortunately, the less-than-perfect reliability of voice input begins to catch up with you quickly. When it came time to pull the "nose up," the VocaLink calmly asked what to do with the landing gear. Several crash landings later, I concluded that voice input is not yet ready to replace

How Speech Recognition Works

The heart of the PC speech recognition system is a two-step process that converts the sound of the spoken word into a digital package or *template,* and later matches it to the same spoken command given during an application program. The same process of converting audio frequencies (analog) to stored templates (digital) is used during speech training and recognition. Both use spectral analysis to take the audio frequency waveform of a spoken word and convert it to a digital template.

The process of human speech, though taken for granted by most of us, is enormously complicated to the audio engineer. Spoken sound shifts rapidly between two different components: vowel sounds produced by a single frequency generator (your vocal chords) and consonant sounds made up of the multifrequency white noise of whooshing air passing teeth, tongue, and lips. Sorting through this jumble of audio babble takes more processing than most of us give our brains credit for.

For computerized PC voice input, processing chops up the pieces of sound in a spoken word and analyzes and records the waveform of audio frequencies in each piece. (Chopping each word into many smaller pieces produces better quality; on the other hand, it uses more storage space.)

One method of analyzing the pieces of sound uses filters that sample sound at specific frequencies (much like the graphic equalizer in a car stereo) and record each level.

Technological trade-offs in speech recognition squeeze the added information for each word template into the relatively small memory capacity of the IBM PC. Several compression techniques reduce the amount of data for higher-frequency sampling rates.

One of these, adaptive differential pulse coded modulation (ADPCM) stores only samples that are significantly different than the one just stored.

Once trained, the voice input software begins to accept commands and to try to match them with the template vocabulary. When it hears a sound, the speech recognition routine must decide if the sound is a word in the vocabulary, and if not, reject it altogether. This process can be adjusted for various levels of background noise with the reject threshold setting.

If the software decides to make a match, it begins the more difficult task of coming up with the right word. When you say a word that the computer has been trained to recognize, that sound will almost always be slightly different than that of the stored template: You have changed the pitch, length, or inflection, no matter how consistently you speak. During training, your repeating the word helps to produce an average sample of your voice pattern.

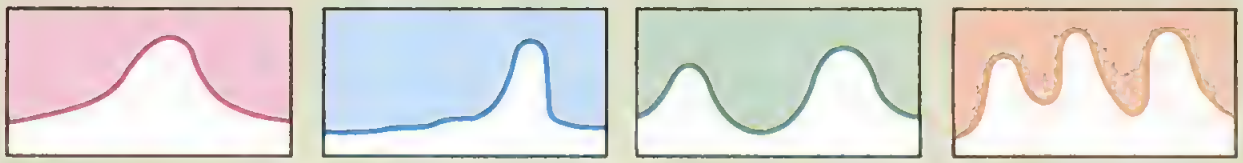
Choosing words with high separation or those that sound different is important. But even with very different sounds, the matching process is not 100 percent reliable. You can adjust this part of the recognition process by changing the separation levels, which determine the difference to allow between the digital values in the stored template and the spoken word. A bigger separation allows more variation in the way the word is spoken, but it also makes more mistakes.

Until new, improved software is developed, voice input must rely on convenience as its main selling point, because it can't match the keyboard in reliability.—J.S.

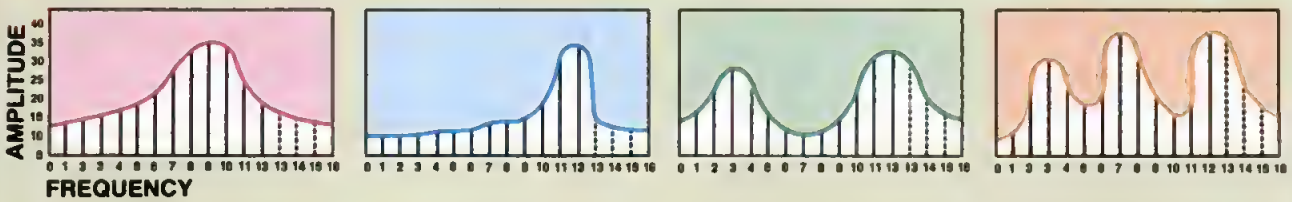
UNDERSTANDING SPEECH

Training a Voice Recognition System to Hear "ONE"

1. *"ONE" consists of four separate sounds: "ooh, uh, nn, and ah."*



2. *Filters sample each sound at one-hundredth-of-a-second intervals to supply values for digitizing.*



3. *The sampled amplitudes are stored in a matrix.*

	FREQUENCY IN HUNDREDTHS OF A SECOND										
SOUND	1	2	3	4	5	6	7	8	9	10	11
"OOH"	15	16	17	18	20	23	30	35	38	37	25
"UH"	12	12	12	13	13	13	15	15	17	20	35
"NN"	18	25	30	25	15	12	11	12	17	26	33
"AH"	11	27	32	24	18	26	39	31	22	16	28

4. *Training establishes a three-part entry in a vocabulary file, NUMBERS.VOC.*

NUMBERS.VOC

COMMAND	KEYSTROKE	MATRIX
ONE	1	15 16 17 16 20 23 30 35 38 37 25 28 12 17 12 13 15 13 15 15 37 20 35 37 18 25 30 25 15 12 17 12 17 26 35 34 11 27 32 24 18 26 39 37 22 16 28 40
TWO		

manual controls in airplanes.

The technology still has a long way to go, and the current level of power and convenience comes with a price: speech recognition is less reliable technology than other popular PC applications. Though PC owners may balk at the prospect of substituting the idiosyncrasies of voice input for the trusty old keyboard, voice input is fairly simple to use.

All the boards I looked at use an expansion slot, and installation is usually a one-screwdriver job. The important difference in hardware design is the amount of independence the board gives the rest of your IBM PC. Some, like the higher-priced VocaLink, have their own 16-bit processor and enough memory to store the entire vocabulary. Others rely on the system memory of your PC. All are invisible to the application program, some more so than others.

SOFTWARE

The board's most important feature is the software. You can use these speech recognition systems two ways. If you want to use voice input for a favorite applications program, you need a speech driver program as the middleman between the voice board and the applications software. It guides you through setting up a vocabulary, training it, and storing it to disk. This is where the choice of a speech board requires the most care. The AudoPilot 1000 and the Tecmar Voice Recognition Board assume familiarity with voice input and guide you step by step through simple development and training of a vocabulary. VocaLink, with added features, requires a closer reading of the manual and a more careful and detailed understanding of the setup process.

The second type of use is to incorporate voice input directly into your own programs. Dialogic includes software to incorporate voice routines in BASIC and C language programs. Tecmar supplies a list of commands that rely on various interrupts of the IBM BIOS, the input/output routines that keep track of information in and out of the PC. Though all these boards give you adequate technical documentation to get started, the process is best left to patient hackers or professional programmers.

FUTURE DEVELOPMENT

The more powerful speech interface features are still on the drawing board. The boards I reviewed are all speaker dependent, but work is underway on voice input systems that will accept commands from many users without the need to use individual templates retrained by each user. Speaker-independent systems are still in the early stages of development.

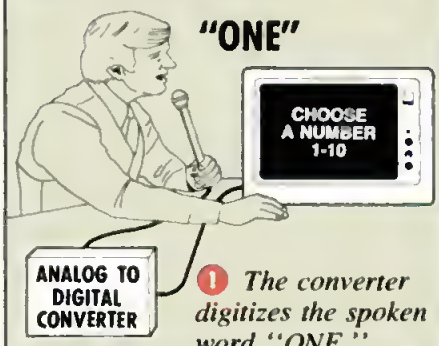
One key area of research in speaker-dependent systems focuses on recognition of several words or phrases at once. By speaking slowly and pausing between words, you must show the current generation of voice input routines where one command stops and the next begins. Connected speech systems will determine those separations for you. One current technique called dynamic programming compares a word spoken slowly with the same word said more quickly and comes up with a match. When you work with voice input at the end of a long workday, the current generation of speech boards doesn't always recognize a tired or frustrated speaker's words. Advanced use of connected speech recognition is expected soon.

Don't confuse connected speech with true continuous speech, however. Researchers concede that continuous conversational speech with computers is many years away. Beyond speech input of several words or phrases, the complexities of language syntax push this technology into deeper theoretical research on advanced parsers—the program devices used to determine the meaning of a string of words—as well as artificial intelligence and parallel processor computer architecture.

Talking to your PC is no longer confined to the realm of science fiction, but for now, the computers' conversational skills are extremely limited. So, if you

THE VOICE RECOGNITION PROCESS

After training, the spoken "ONE" is compared to entries in the NUMBERS.VOC file.



1 *The converter digitizes the spoken word "ONE."*

SPOKEN ONE	14,16,17,17,20 . . .

2 *The program looks for similar entries in the file.*

NUMBERS.VOC

COMMAND	KEYSTROKE	MATRIX
ONE	1	15 16 17 18 20.
TWO	2	26 41 28 29 42.
NINE	9	14 17 18,19 20

2 *The converter compares the spoken word "ONE" to similar file entries.*

SPOKEN ONE	14,16,17,17,20 . . .
ENTRY ONE	15,16,17,18,20 . . .
ENTRY NINE	14,17,18,19,20 . . .

4 *The program chooses the closest match, the entry for number "ONE."*

5 *The program sends the keystroke "1" to the CPU.*

6 *The "1" is displayed on-screen.*

confide in your machine as you would in a friend (or scold it as you would a truculent child), take heart. You needn't worry about offending or upsetting your PC with a heated or thoughtless remark. For now at least.

VOCALINK

Of the speech recognition boards I reviewed, VocaLink is the most powerful and versatile. At $2,100, including microphone and speech synthesizer, that's to be expected. But it's also considerably more difficult to use.

The VocaLink board has the advantage of being invisible to your PC, one of the reasons for its $1,650 price. Although other boards use system memory to store the common vocabulary, VocaLink has its own 16-bit Intel processor and 128K of its own RAM, and so it acts independently of the system board. VocaLink also uses an optional $350 voice synthesizer to talk back to you, asking for the next command, or, when programmed for so-called *soft reject* of commands, prompting you to repeat the command for clarification.

The VocaLink is apparently designed for industrial use, and though its reliability seemed no better than the others, it could accept a larger vocabulary—up to 240 words. Adding a speech synthesizer to voice recognition routines adds another dimension, but the extra performance requires a little more work and patience from the user.

Installation, though reasonably simple, involves a Hydralike cabling system that uses a 25-pin connector to link the board with separate wires for keyboard, microphone, synthesizer, and external speaker or headphones.

The VocaLink has two potentially helpful LED lights to monitor the board's performance: green to confirm that the board is ready, and red to show that the system is accepting voice commands. Unfortunately, the lights are on the back of the board and are so hard to see, they are nearly useless.

Setting up the VocaLink vocabulary is not simple, but the manual and help screens in the utility program are fairly self-explanatory.

The first branch of the utility program, enrollment on the menu, starts with creating and storing a vocabulary of command labels. The menu is fairly easy to use, but VocaLink's special process of "syntaxing" commands requires extra thought. The vocabulary is organized around syntax nodes, which can be used to branch from one logical cluster of commands to another.

You have extra setup because each vocabulary command includes four separate entries: the command label, the keystrokes generated by the command, the response word for the synthesizer, and an optional "reject threshold" for each command. The reject threshold determines how fussy the board is about accepting or rejecting a command.

Once you enter the vocabulary file, you name and store it to disk. The enrollment menu's last chore is a routine called a separability test for each template file. Here you can speak commands on a trial basis, and the computer prints on the screen what it thought you said. The test also shows three other results: a running average score of correct words, the runner-up (or next most likely word template match), and a type of threshold called the delta, which can be reset to improve consistency.

FACT FILE

VocaLink
Interstate Voice Products
1849 W. Sequoia Ave.
Orange, CA 92668
(714) 937-9010
List Price: $1,650, speech recognition board; $185–$250, microphone; $350, speech synthesis option.
Requires: 64K RAM, one double-density disk drive.
CIRCLE 681 ON READER SERVICE CARD

AudoPilot 1000
AudoPilot Inc.
P.O. Box 3006
516 Walt Whitman Rd.
Huntington Station, NY 11746
(516) 351-4862
List Price: $459, speech recognition board; $110, microphone headset.
Requires: 256K RAM, one double-density disk drive.
CIRCLE 679 ON READER SERVICE CARD

PC-Mate Voice Recognition Board
Tecmar, Inc.
6225 Cochran Rd.
Solon, Ohio 44139-3377
(216) 349-0600
List Price: $995, speech recognition board; $170, microphone headset.
Requires: 64K RAM, one double-density disk drive.
CIRCLE 680 ON READER SERVICE CARD

VPC 2000 VoiceCard
Votan Corporation
4487 Technology Dr.
Fremont, CA 94538
(415) 490-7600
List Price $2,450
Requires: 256K RAM, one double-density disk drive.
CIRCLE 682 ON READER SERVICE CARD

Dialogic 2
Dialogic Corporation
164 McKinley Ave.
East Hanover, NJ 07936
(201) 386-0202
List Price: $495, includes telephone interface and software.
Requires: 192K RAM, one double-density disk drive.
CIRCLE 678 ON READER SERVICE CARD

The average score seemed to be about 85 percent reliability, for example, on the 100-word *Flight Simulator* vocabulary. With the third branch of the menu, called parameters, you adjust the audio levels, the reject thresholds, and the filters. You adjust the gain the same way you adjust a microphone level on a tape recorder. You need to adjust the reject threshold if there's much background noise. The filters, used to sample your voice template at 16 evenly separated audio frequencies, can be swept by a test subroutine to determine if the background noise is too distracting for the match routine.

At the time of this review, the software and the manual (marked prerelease) were obviously in the final stages of development, not quite ready for the market. The manual, for example, referred to a utility program branch for testing the system that was missing from the software. Several help screens listed only notes of what was to be included in the final version. An attachment at the front of the manual noted a series of bugs in the firmware (the VocaLink board's programmed ROM chip). VocaLink planned an IBM look-alike binder for the manual, though it was not back from the printer. I reviewed a three-hole-punched, green-striped, dot-matrix printout.

I found other annoying bugs that were not as easy to understand. To begin with, the system is not set up for a monochrome monitor with a color graphics board, making help and menu screens nearly illegible; they were covered by an annoying gridlike pattern that color programs produce on black-and-white monitors. The program's inclination to search all disks, including a nonexistent "C" disk, for stored vocabulary and template files, rather than use the PC-DOS PATH command, annoyed me. A system setup routine might avoid these problems.

The program also ran aground a few times for no apparent reason. Once, after loading the vocabulary and template files and setting the machine in the recognition mode, the system locked and would not respond to voice or keyboard commands. Another time, the vocabulary input screen refreshed itself, leaving behind none of the appropriate prompts or labels, and displaying only the cursor and input words. At the time of this review, VocaLink needed some work to make it a reliable, powerful performer that justifies a higher price than that of its competitors.

VocaLink is not for the everyday user, particularly at this price; setup and use take a bit of patience and practice. But as a practical substitute for keyboard input, it is an impressive preview of a speech recognition system that harnesses much of the power this new technology offers.

For the price, the AudoPilot seems to be the best of the boards I reviewed.

AUDOPILOT 1000

The AudoPilot 1000, the smallest and simplest board, has a relatively low price of $459. For the price, the AudoPilot seems to be the best of the boards I reviewed.

Besides its simplicity and low cost, this board was the simplest to install. Less than half the size of the full-length VocaLink and Dialogic boards, it took only a few minutes to install. AudoPilot works well with the recommended optional Shure earphone-microphone headset ($110). The real strength of the system, however, is its software.

Though your preplanning of input organization and vocabulary is still critical to get the most separation between words, the AudoPilot system is simple to set up. One helpful feature lets you display the vocabulary with windows at any point during setup or operation of the application program by simply hitting the large Plus key next to the keypad. With another strike of the Plus key, another window, you can enable or disable the voice input system. The simple pause feature lets you temporarily shut off the voice end of the system and revert to full keyboard control any time.

And the board comes with preprogrammed vocabulary sets for some of the more popular IBM PC programs, including *1-2-3*, *WordStar*, *Multiplan*, and *VisiCalc*. The main AudoPilot editor program is simple to use and can be made even easier to use with the most convenient option of them all, the mouse, though I didn't use the mouse for the review. You can correct individual words without having to run through the whole list.

The main drawback of the AudoPilot is a byproduct of its simplicity and compactness. Because it does not have its own memory, the board relies on your PC's system memory to store the vocabulary templates, which are loaded one at a time to memory, referred to by AudoPilot as the *library*. You can store only 32 words in each file, but AudoPilot says up to 32 files can be loaded in the library at once. You can review each file displayed in a new window by hitting the Plus key. The problem with this system is twofold. First, AudoPilot can be used only with programs that can be loaded directly from PC-DOS. If you set up AudoPilot and try to use *Flight Simulator*, for example, *Flight Simulator* takes over and clears out the portion

of memory where the library of vocabulary commands was just loaded.

Even for some programs that load from DOS, the library gobbles up memory fairly quickly. The manual says that each vocabulary file takes up 1K to 6K of memory. But even with a ten-word vocabulary, for example, *DisplayWrite 2* won't load on a system with 256K RAM. But *EasyWriter* and other smaller programs loaded with room to spare. And to recapture library space, you must reboot DOS. If your application program is large, you may need more memory.

The AudoPilot 1000 performed as reliably as the rest of the boards I reviewed; like the others, it produced some unexpected results. You can adjust the separation and reject parameters on the AudoPilot, but I didn't find that changing the default values improved the performance. The best bet for correcting faulty recognition on the AudoPilot, as with the other boards I tried, involves rewriting the vocabulary using more distinct words and retraining for maximum separation.

The program manual is straightforward, avoids technical jargon, and provides some helpful background on how the hardware and software work. For the beginner who would like a simple, reliable voice input system at a reasonable price, the AudoPilot 1000 is the best I reviewed.

TECMAR VOICE RECOGNITION BOARD

The Tecmar PC-Mate Voice Recognition Board falls between the VocaLink and AudoPilot in price ($995 plus optional microphone), vocabulary capacity, versatility, and ease of use. The manual was simple to follow and the software well designed; the system also performed as well or better than the others. Despite some troublesome installation problems, this board stands as a good example of the solid potential of reliable voice input in various application programs.

The PC-Mate performed extremely well on a small sample vocabulary of 20 commands.

Tecmar's board, like the VocaLink, uses its own memory to store the vocabulary and speech templates, and so it does not require system memory. Though only 8K of RAM is available on the Tecmar board, the manual says it will support a vocabulary of 100 words. With a 16K option, a 200-word vocabulary is available. (Programs that do not run under PC-DOS, however, are apparently not available to the board. The board recognized my vocabulary when I loaded *DisplayWrite 2*, but it did not survive the soft reboot needed to load *Flight Simulator*.)

The system software and setup procedures are easy to use and similar to those of the other boards. First you use an edit program to enter a list of vocabulary commands and the corresponding keystrokes, which can be edited as you go along by simply putting the cursor on the entry you need to change. Data entry follows a bit different procedure; for example, some direct command keystrokes such as Enter, Escape, Shift, and so forth must be preceded by the Escape key. Corrections and additions are fairly simple.

The routine also stores files (you give a filename when you start the program) and makes a backup copy automatically. Once you enter and store commands, you train them with the utility program. You can do this with one pass of the list; you can refine the commands with additional repetitions. One helpful feature of the training mode is that the program produces two test results as you speak each word, showing how well the spoken word matches the voice print stored so far. Once trained, the template is stored in a file that you name separately.

The board's utility program, like the VocaLink, also has a separate test routine that lets you check how well the system recognizes words in your vocabulary before you set it to work. The board performed extremely well on a small sample vocabulary of 20 commands. Though the test had no running score, accuracy on the small sample was more than 95 percent. Larger vocabularies, however, ran into problems, particularly with shorter commands such as "a" and "eight," or "five" and "nine." The accuracy rate, as with the other boards, also drops over time as the speaker gets tired, frustrated with an unruly word, or tries to speed things up. But in general, the recognition was as good or better than average.

At the time of this review, Tecmar was still refining software and documentation. (The manual I had was a photocopy of a dot matrix printout, with diagrams missing.) But as presented, the instructions were simple to follow, assumed no understanding of speech recognition, and provided the least amount of technical information necessary. For software developers and serious hackers, however, the hardware manual gives detailed instructions on incorporating the speech board in their programs. This includes speech commands that communicate with the IBM PC system board (using BIOS interrupts). An earlier version of the software included sample routines to demonstrate them.

The board's only drawback is that it's

difficult to install because of a minor flaw, which produced a major headache when I tried to fit the board into the expansion slot.

If you look at the vertical metal bar on the back edge of all PC boards, you see the bar is slightly offset to the right (facing the back of the PC). When the tab on the bottom (holding the gold contacts) is slipped into the slot on the system board, the opening in the chassis for this bar is also slightly to the right of the slot. The Tecmar board has the metal bar lined up in the middle of the board, with the microphone jack dead center in the bar. So when you try to install the board, it doesn't fit; with the tab lined up with the system slot, the bar is too far to the left. And if you jammed the board in (damaging the components), the microphone jack would be inaccessible.

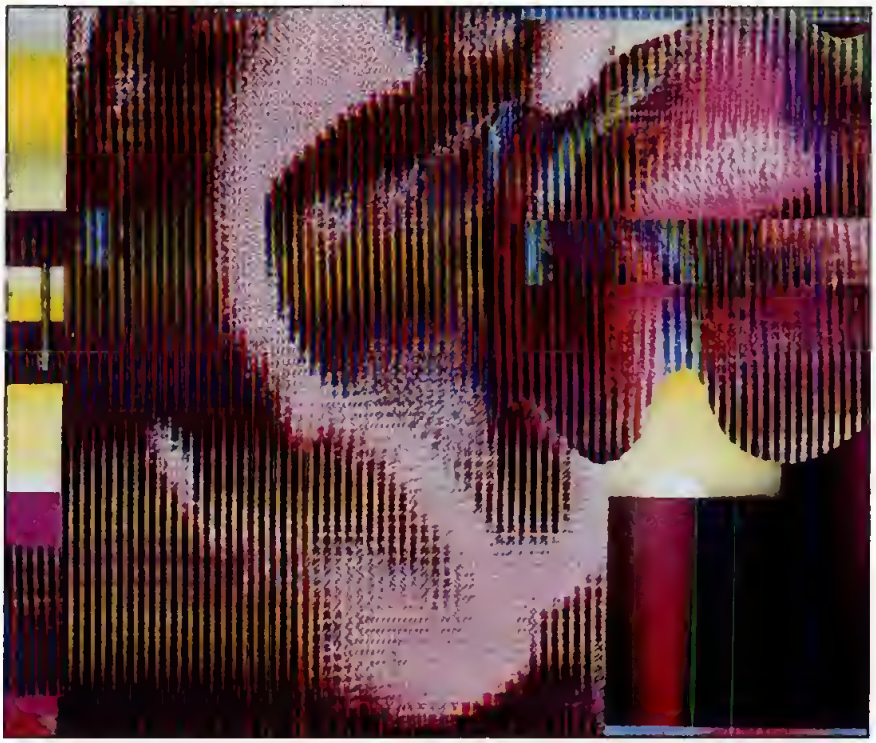
The only solution I found was to unscrew the metal bar from the back edge of the board and leave it loose on the side to make room for the microphone. This is possibly a quality control problem with the board I received, but there were no apparent manufacturing defects. When I called Tecmar, a representative suggested that my PC was the cause. But the problem is still to be resolved.

VPC 2000 VOICECARD

Imagine approaching your computer and saying, "Good morning, computer—let's do *1-2-3*—new—quarterly—financial." As you watch, your computer loads and calls *1-2-3*, resets the columns, and loads the quarterly statement templates.

Imagine next saying, "Go to Income—write—dollars—four—niner—niner—decimal—five—eight" and seeing that quantity entered in the appropriate cell. You get the idea, kind of a mini HAL without the backtalk. That's what Votan's VPC 2000 system is all about.

The 13-inch board is piggybacked (with a Clifford telephone interface board)



but nevertheless fits into a single expansion slot. The package includes an IBM-type manual and the driver and voice applications development software and demo programs. Votan also provides a high-quality microphone and a high-quality 16-ohm speaker and pot. The microphone is used to teach the board your voice and later to input commands into the system. The speaker is used for general-purpose monitoring. Votan also provides an RJ11 phone jack for input-output.

INSTALLATION

Installation is a painless process. The board slips into any open expansion slot; the microphone and speaker plug into the rear support bracket from the outside. The only other thing you'll have to worry about, as with similar boards, is to be sure the default I/O port and interrupt location don't compete with other installed boards. If there is a conflict, you must reset a DIP switch.

The heart of Votan's system is a proprietary speech synthesis scheme, but it's centered on a synthesizer large-scale integration chip and several proprietary encoding and decoding chips. The quality of speech generated seems to be somewhere between that produced by adaptive differential pulse coded modulation (ADPCM) and linear predictive coding (LPC) techniques.

The Votan board has found its way into many sophisticated original equipment manufacturer and value-added retail products because of the flexibility its software support supplies, including a Voice Application Development Language (VADL), a compiler, executive and vocabulary building, and, of course, the VoiceKey speech response terminal driver.

VADL, not for beginners, is a fairly sophisticated programming language that gives the programmer direct access to the voice features of the Votan board, unlike other systems in which the board must be accessed through assemblerlike calls to driver routines.

With VADL, just about any voice application can be generated, from simple voice prompts to sophisticated phone communications that can effortlessly han-

dle both voice and Touch-Tone incoming data.

Each piece of software controlled by VoiceKey must have its own list of commands, or a template, which begins as a simple text list of all commands for the application. A calculator application, for example, would have all the digits and arithmetic operators and conversion units.

Next, you must train the words in the template to your voice by calling up the list on a Votan utility and reading each word (into a microphone attached to the Votan board) one or more times. The template is then checked to be sure that the system recognizes each word as spoken. The process is repeated until the template is perfect.

Testing is pretty rigorous. Unlike many voice recognition systems, the Votan board can handle continuous speech. Therefore, a test of the calculator template might involve reading number groups strung together to make sure Votan could sort the individual numbers from the voice string. You can add additional voices the same way.

Finally, to run the applications program, you begin by loading the Votan drivers (VKRUN), followed by the template for the application software (VKLOAD "filename"). Then you load the applications software and run it by voice. The process sounds pretty easy, and it is. More importantly, the system works just as it was advertised.

Though Votan's board can be used by the experimenter, the board is designed specifically for commercial and industrial applications. The voice applications programming language and VoiceKey bring a programming flexibility to this product line not found in all voice board systems.

For the serious user, the Votan board is another system that you must look at and consider carefully. Votan's technical support personnel are eager to help the product designer with software and board fit.

—Dick Aarons

Unlike many systems, the Votan board can handle continuous speech.

DIALOGIC 2

Dialogic has approached its speech board development differently, and it's still too early to judge the outcome. The second-generation Dialog 2 does not perform speech recognition, but the company says it includes all the hardware used to store and retrieve voice templates in a system that records and stores messages from a microphone or over the phone. Dialog's marketing people are apparently pitching the board to those who want to do telemarketing, voice messaging, and other speech storage applications. Dialogic believes the board has the potential to act as a type of sophisticated answering device, but I believe it's not there yet.

The Dialog 2 produces high-quality recordings using a speech compression system similar to other speech recognition boards. But the usefulness of this system for recording on the PC is limited by the relatively large amounts of storage required.

A sample program called *Tape*, which operates like a tape recorder, demonstrates how this works. The fastest sampling rate of 8 kHz, like a tape recorder's higher speeds, produced the best-quality recording by digitizing and storing more bits of speech. I completely filled a double-sided floppy disk, however, in about 90 seconds of continuous speech. Through the use of *Tape*'s lower speeds and a compression mode (which removes the pauses between words and phrases), the record time can be increased to about 5 or 6 minutes. But the average telephone answering machine can handle up to 30 minutes with just about the same quality.

The Dialogic 2 also gives you a software package with BASIC and C language routines that let you incorporate spoken messages in programs written in these languages. In this way, Dialogic says, you can use its board to develop "voice database" routines. Combined with a larger storage system, for example, such routines might be used to program a telephone sales call that records responses to different questions. But storage is a key stumbling block.

The full Dialogic line includes the Dialog 1 ($295, without telephone interface), the Dialog 2 ($495), and the Dialog 3 ($595, with telephone interface and 300-baud modem). The complex software available at the time of this review suggests that these boards will appeal to program developers. For now, Dialogic seems interested in finding third parties to develop applications.

The appeal of the Dialogic boards is their low cost, and the company's claim that the hardware is capable of full speech recognition. If Dialogic (or someone else) can develop simple, reliable speech recognition software at a low price, the company may have something. Otherwise, Dialogic needs to focus on more versatile applications for the telephone speech storage system.

John Schoen, a former newspaper reporter and editor, lives in New Jersey and writes magazine articles on an IBM PC.

COMPUTERIZED TELEPHONE PRODUCTS FOR THE PC RUN THE GAMUT FROM ENHANCED MODEMS TO SOPHISTICATED SYSTEMS OFFERING VOICE SYNTHESIS AND ALL TYPES OF COMMUNICATION MANAGEMENT.

The PC-Telephone Connection

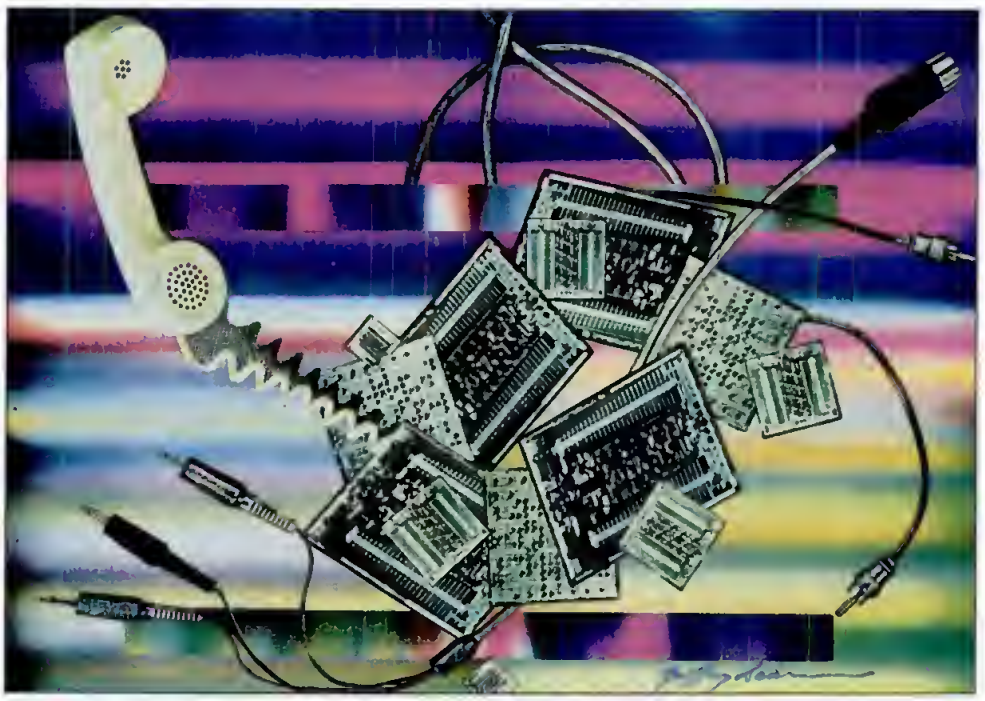


Illustration: Jeffrey Schrier

THOSE OF YOU WHO WORK IN AN OFFICE have probably had to deal with the eccentricities of a computerized PBX (Private Branch Exchange)—such as the fact that your telephone becomes semipermanently inoperative if you dare to unplug the modular telephone jack. And if you use a telephone at all, you've heard the operator tapping at the keyboard of the computerized directory or had the synthesized voice direct you to "dial 0 for operator or enter your

credit card number now." But these are minor annoyances compared to the extensive opportunities for communication that computerized telephones give you.

Several forward-looking companies now offer systems that combine with your PC to put the strengths and intelligence of a local computerized telephone system right on your desktop. These hardware/software combinations will let you momentarily set aside a PC task, take a call, send a screen of data to the caller, discuss the data while you both look at identical screens, then resume your task on the PC. Now if only they could take over and chat with an unwanted caller.

ASHER

Asher is a hardware/software product that attempts to utilize the power of the PC to simplify and add flexibility to day-to-day telecommunications. It includes a 300-baud modem and can control two phone lines while maintaining a phone directory and a calendar/appointment system on disk.

Installing Asher involves little more than plugging it in a full-length expansion slot. The Asher resides at a normally unused I/O address, and so it does not use or conflict with either COM1: or COM2:. If desired, the Asher base address can be changed by setting a small DIP switch on the board. Three standard RJ-11 modular jacks sit on the rear of the board, one each for a telephone handset (there is no provision for connection of a complete telephone) and two phone lines.

Quadram distributes Asher with a version of *Memory Shift*, a memory-partitioning program that divides available RAM into partitions that act like separate PCs. The idea is to have Asher run in one partition and one or more application programs run in other partitions. This system allows you to access Asher features without having to dedicate the entire PC to phone control functions.

Quadram provides batch files to ease installation and invoke the Asher installation programs, but my attempt to install the product on my hard disk system brought a problem to light. The manual says to type HDASHER for hard disk installation, but there was no such file on the distribution disk! Fortunately, I have some experience with *Memory Shift* and was able to figure out what to do from the batch files.

The installation program is somewhat more powerful than that normally supplied with *Memory Shift*, but it is also less clear in many respects. The sketchy and inadequate documentation doesn't help. Particularly weak is the discussion, or lack thereof, about disk checking. Experienced *Memory Shift* users know that this function is rather a major issue, but Wilcom's portrayal of the subject is misleading and unacceptable. To make matters worse, Quadram's default is to disable disk checking: a sure invitation to problems in a floppy-disk-oriented system.

SETTING PARAMETERS

Once you have defined the partitioning, the system administration function allows you to set various Asher parameters. The program requests your last name, first name, and birthday (the program wants to wish you a happy birthday, of all things!); a "user number" that identifies who entered the information (it is unclear what use the program makes of this number as even the manual tells you to ignore it); and a two-digit security code (the manual tells you to ignore this request too). You then enter codes for local access to make local calls from a business line, in-state long distance, and interstate long distance. It also requests the numbers of alternate long-distance carriers, such as MCI or SPRINT, and the method used to include the user's ID code.

The program also allows you to specify the disk drive used to store the Asher pro-

FACT FILE

Asher
Quadram
4355 International Blvd.
Norcross, GA 30093
(404) 923-6666
TWX 810-776-4915
List Price: $696 w/300-baud modem, telephone handset, two telephone cables, file card system.
Requires: 128K RAM, DOS 1.1 or later.

CIRCLE 670 ON READER SERVICE CARD

VOAD Keyboard Phone
VOAD Systems
12301 Wilshire Blvd., Suite 101
Los Angeles, CA 90025
(213) 207-8866
List Price: PC $209.50, terminal $249.50.
Requires: One disk drive, DOS 1.1 or later.

CIRCLE 671 ON READER SERVICE CARD

Watson
Natural MicroSystems
6 Mercer Rd.
Natick, MA 01760
(617) 655-0700
(800) 6WA-TSON
List Price: $849 w/300-baud modem; $998 w/300- to 1200-baud modem.
Requires: 192K RAM, two disk drives, DOS 2.*x*.

CIRCLE 672 ON READER SERVICE CARD

Cygnet CoSystem
Cygnet Technologies, Inc.
1296 Lawrence Sta. Rd.
Sunnyvale, CA 94089
(408) 734-9946
List Price: $1,495 w/300-baud modem; $1,845 w/1200-baud modem.
Requires: 256K RAM, two disk drives, DOS 1.1 or later, RS-232 board.

CIRCLE 673 ON READER SERVICE CARD

Asher divides the screen into windowlike areas. The telephone handset plugs into a standard jack in the Asher board.

grams, data, and archive files. You can select various program options, which include searching for stored data by a follow-up date stored with each phone record, appending the account number required by some PBX systems, and so on. The Asher hardware's base address and phone line sensitivity can also be adjusted. The installation procedure even allows you to program the PC's function keys and control how the program uses color displays.

Once all this preparation is done, invoking Asher itself is straightforward. The program divides the screen into logical areas somewhat like windows, although they are not highlighted as such. The current function key definitions occupy large boxes on the left side of the screen, a calendar of the current month appears in the top center with today's date highlighted, a box in the upper right shows currently available menu options, and the date and time appear in the lower right corner of the screen. The central part of the screen displays the output of the various functions.

Asher's calendar function is primitive but usable. Entries occupy an abbreviated screen line and can contain a two-character "status" variable (this variable can be any characters that have meaning to you; Asher ignores this field), a time, an indication of whether an alarm should be sounded at the time of the appointment, a duration, a name, and 20 characters or so of notes. This list is hardly comprehensive, but it does convey the essential information.

Asher stores phone numbers on a simplistic and restrictive card format. Name and address data and the access code required (whether local, intrastate, or interstate, for example) can be stored.

Asher's Speedial option searches through the stored file cards based on whatever characters you enter. When it finds a match, it displays the matching card. The system can handle two phone lines, which can be either key, PBX, or central office (home), and dialing numbers is simple. Either outgoing line is selected with either F9 or F10, and the program will dial the number on the displayed card or accept keyboard number entry. The box for F9 or F10 is highlighted to show the line is in use and also displays the call duration. An incoming call "rings" the PC's speaker, and you can answer it by hitting one of the function keys. Obviously, if you are executing an application program when you receive an incoming call, you must switch partitions in order to wake Asher up before you hit the appropriate function key.

ON-BOARD MODEM

Quadram also supplies a communications program called *Asherlink* to use the 300-baud on-board modem. *Asherlink* is a free-standing application program and, as such, must be run in its own memory partition. The program maintains its own set of file cards distinct from those created with the main Asher software. These cards can specify the required logon sequence based on the host computer's prompts, your responses, and any necessary time delays. This nicely implemented system is easy to understand and use. When communicating with another Asher system, *Asherlink* switches automatically between voice and data communication. *Asherlink* can handle file transfer, but the documentation gives no indication of whether any error-checking protocol, such as *Xmodem*, is used.

My tests of Asher were uneventful once I overcame the installation problems. Whether the Asher software operates simultaneously with an application program depends on whether the programs are happy with *Memory Shift*. While this partitioning program richly deserved its negative reputation in its early incarnations, it has been greatly improved and works reliably with many (but not all) standard DOS programs. In my experience, it is essential to enable the program's disk checking function, and so Asher users are strongly advised to override Quadram's disabling default.

The Asher software displays some annoying inconsistencies. For example, the program continues to instruct you to insert the Asher disk in drive A: when the

program is ended for the day and it is time for the files to be archived, even if different drives have already been specified for this function. The program will actually perform its functions on the disks you have designated; however, the prompt remains wrong.

The software is generally primitive compared with other phone directory and calendar/appointment desktop assistants, and it has a few bugs and problems as well. While the user interface is not bad, the programs simply don't do that much. There's no calculator or notepad provided. Asher works only when the power to the PC is on; if the system is off, the handset is totally inoperative—and it has no provision for a regular telephone. Also, the documentation for the modem is woefully inadequate.

The modem worked correctly, and the *Asherlink* software isn't too bad. However, the modem operates only at 300 baud in a world increasingly oriented toward 1200 baud. *Asherlink* doesn't hold a candle to today's truly sophisticated communications programs.

Quadram should be commended for including *Memory Shift* with its product to address the problem of concurrent phone control and running of normal applications. Nevertheless, Asher must be considered a disappointment. Devices and software that integrate the PC and the telephone system are proliferating rapidly, and Quadram must get moving if it wants to keep up.

VOAD KEYBOARD PHONE AND DIAL-A-DEX SOFTWARE

The VOAD Keyboard Phone is an interface between an IBM PC or compatible and the standard telephone network. It comes with VOAD's *Dial-A-Dex* software, which maintains phone numbers and other information in a Rolodex-like database and generates phone usage and other helpful reports.

VOAD includes a few simple-minded BASIC examples for controlling the Keyboard Phone, and it would be easy to devise sophisticated telephone programs in almost any high-level language.

The VOAD hardware is a white plastic box measuring a compact 6¼ inches by 7½ inches by 2 inches. A normal phone handset is connected to a standard RJ-11 modular jack. No regular telephone is needed, but VOAD provides an auxiliary modular jack for connecting a phone for use when the computer is off. The VOAD connects to the phone line with a permanently attached modular cable; if it isn't long enough, you'll have to use an extension cord. A female RS-232 serial jack connects the VOAD to the computer. The Keyboard Phone can draw its operating power from the telephone line, but a small plug-mounted AC power supply will power the device if phone line power is inconsistent or many devices are connected to one phone line. Internal DIP switches set the serial baud rate (up to 9600 baud), data word length and parity, tone versus pulse dialing, and pulse rate. These switches are reasonably easy to get to, but most users will want to use the factory default settings, so chances are no changes will be required. An LED on the front of the unit indicates when the line is active and a push button answers incoming calls when the computer is off. The device is designed to be mounted under a desk or table surface with the screw holes or double-sided tape supplied.

The hardware responds directly to 14 commands in a simple and straightforward syntax. The commmands cover typical phone functions such as answering, dialing, hanging up, and so on. Both "dumb" pauses (delay for 2 seconds) and "smart" pauses (wait for a dial or access tone) are provided. VOAD includes a few simple-minded BASIC examples for controlling the Keyboard Phone, and it would be easy to devise sophisticated telephone programs in almost any high-level language.

DIAL-A-DEX

While these commands allow the Keyboard Phone to be used with CP/M and other systems, most PC users will never use this programming capability, however, and will opt for the VOAD *Dial-A-Dex* software. This package is primarily a Rolodex-like database manager that stores name, address, phone, and other information as well as phone usage. It maintains a list of often-dialed numbers and also maintains data on a much longer list of potential contacts. The stored data can be converted to a general format usable by word processing merge programs, and so you can use the program as a general purpose contact database.

Dial-A-Dex uses the PC's function keys well, with almost all commands issued by hitting just a single function key. The functions assigned to each key change throughout the program, but they are very clearly indicated both at the bottom of the screen and in longer on-screen text descriptions. Since most of the available operations are reasonably obvious and the program delivers good on-screen help throughout the entire system, little reference to the terse but adequate documenta-

tion is necessary. The 37 separate help files mean that the system occupies quite a few directory slots.

The main card file system displays a representation of a Rolodex card on the screen, but the 16 available fixed fields are formatted with enough flexibility to make this structure not as restrictive as it seems. In addition to the obvious name and address fields, VOAD includes two amount fields as well as identification, memo, action date, and record selection fields. This last field consists of 16 characters divided into eight distinct 2-character subfields and can be used for any identification codes you devise. There is also a 6-line- by 64-character "note" area for storing lengthy information. This well-thought-out structure could be used in many database applications.

The card file program has a search provision that can locate user-specified information in any of the first 15-card fields or in any of the 2-character subfields in the 16th field. The program can print both the card and note information onto standard-size continuous Rolodex cards.

Dial-A-Dex's "active list" is a totally separate system that maintains a list of names and telephone numbers of frequently called parties. There is no connection between this data and the card file system; it is usually necessary to enter a common contact in both systems. Active list names are displayed on screen with the current selection highlighted. Function keys can scroll the current selection within the list of common numbers and add, edit, or delete entries.

A utility system allows deleting the various data files maintained by *Dial-A-Dex*, indicating the drive to use for data files, entering MCI or SPRINT prefixes for use of these or other alternate long-distance carriers, and so on.

Dial-A-Dex stores the date, time, number called, and duration of all outgoing calls placed through the system. It does not keep track of incoming calls in any way. The systems report option prints a nicely formatted report of the outgoing call information and can also produce printed listings of the active list of commonly called numbers. The program can convert stored card file data to the ASCII format used by the merging function of *The Writer* or *PIE Writer* word processors. An unusually flexible mechanism specifies which fields to include in the ASCII file, and you can specify which records will be included. This conversion process works well, but the selected word processors are not exactly giants in the PC world. The conversion utility would be much more useful if it supported *WordStar*, Microsoft's *Word*, *WordPerfect*, or *MultiMate* formats.

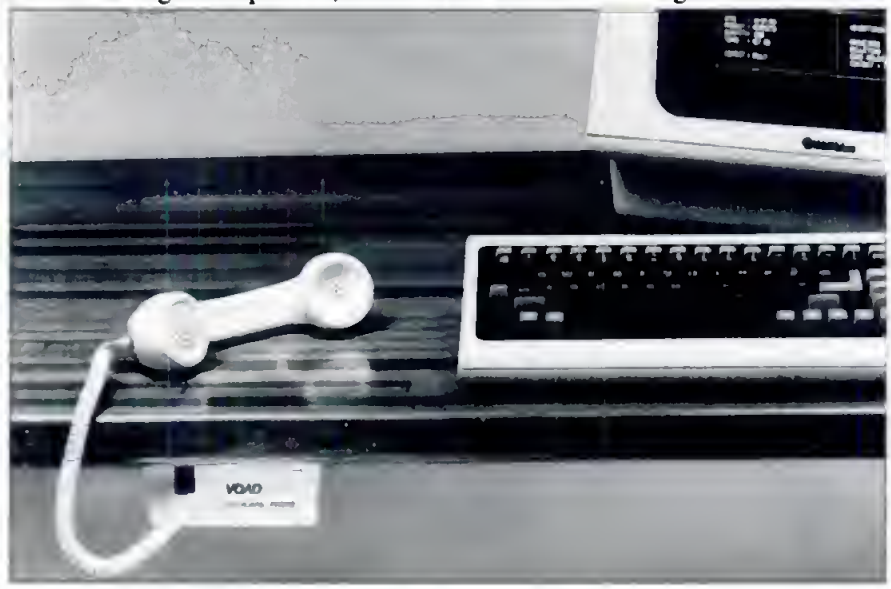
EASY DIALING

Dialing an outgoing call is as easy as hitting the appropriate function key and selecting the number to dial from the Active List or entering it manually from the keyboard.

The VOAD Keyboard Phone and *Dial-A-Dex* software work exactly as claimed, but omissions and at least one major weakness detract from the system's effectiveness. The *Dial-A-Dex* software has no provision for background operation, and so it hogs the entire resources of the PC. Fortunately, it works correctly in a memory partition set up by *Memory Shift*, so potential purchasers should include the cost of *Memory Shift* or a similar package when calculating the cost of the system. Extra RAM may be required to allow *Dial-A-Dex* and normal applications to work with *Memory Shift*, adding further to the cost.

The software itself does not include any notepad, calculator, or calendar/appointment functions. Thus it is not competitive with the desktop support packages available from various vendors. The hardware works as claimed but does absolutely nothing when the connected PC is off, has no modem or other telecommunications features, works with only one phone line, and has none of the digital voice synthesis, store and forward, or other advanced functions now appearing in PC telecommunications peripherals.

On the other hand, the VOAD system costs less than many other telephone support systems. It works well and is certainly better than no phone device. Nevertheless, I feel the system's cost effectiveness equation results in a negative balance. The



VOAD requires no regular telephone. A phone handset plugs into the white plastic VOAD hardware box with a standard jack.

VOAD is neither particularly powerful nor particularly sexy. It's not exactly bad, but many other products in this burgeoning category are more attractive.

WATSON

Watson, from Natural Microsystems of Natick, Massachusetts, is an exciting device that brings many mainframe and minicomputer telecommunications capabilities to the world of the IBM PC. It includes voice synthesis, voice digitization and storage, voice mail, speech editing, Touch-Tone recognition, modem communications, and more. Among other things, it can function as a super-sophisticated answering machine, a phone directory, a calendar/appointment manager, and a normal modem.

Physically, Watson is a full-length expansion card that plugs into a PC. Installation is a simple plug-it-in-and-run proposition. The Watson normally shares interrupts with the COM2: serial device. If this is a problem, the board can be configured to act as COM1: instead. The rear of the board has two standard RJ-11-type modular plugs: one for connecting a normal telephone and the other for connecting the board to the telephone wall jack. This connection scheme allows the telephone to operate normally when the computer is off or the Watson software is not in use.

The software is not copy protected and can easily be copied to a system's hard disk. This feature is important, since Watson's software occupies 192K, making a hard disk more or less a necessity. Watson opens a large number of files during normal operation, and so you must specify approximately 20 files in CONFIG.SYS, requiring DOS Version 2.*x*. Setting the Watson configuration completes the installation procedure. Some of the options are straightforward, such as indicating how many rings before Watson answers the phone. More interesting options concern the degree of compression to use for incoming and outgoing messages and phonebook, calendar, and dictation entries. The choice between high and low compression is a tradeoff between speech fidelity and disk storage requirements.

Watson allows manipulation of stored speech just as a word processor allows manipulation of text.

Watson's screen displays are consistent throughout the program. A status line in the center of the screen divides the screen into an upper and lower window. It also displays the time, date, and various other status messages. The line below the status line is used for longer messages, menu options, and the like. The system uses a Rolodex-type card as a consistent metaphor. Each card has four lines, and a series of cards is displayed on the top half of the screen. The bottom area holds help messages and other displays.

The PC's cursor and editing keys work in more or less normal fashion, but most of the Watson functions are executed with function keys. The key definitions seem confusing at first. Fortunately, Watson can display all the key functions at the press of a key, and you become comfortable using them after a while.

Watson is organized into five card files: phone book, outgoing messages, incoming messages, calendar, and dictation. A card is used for each individual in the phone book, each message, each calendar entry, and so on. Any card may contain an associated speech recording. The card's status line indicates if speech has been recorded "on" a card, and hitting the F9 key plays the speech back through the attached telephone's handset.

THE PHONE BOOK

A card in the phone book file includes at least the party's name and phone number. Watson can detect dial tones or can be instructed to pause for a fixed time period. It offers several interesting enhancements. An ID code can be assigned to an individual. If that party calls in, a mechanism is provided to allow the caller to transmit an ID code to Watson. A speech message can be left for that ID code only, and the caller receives a message by providing his or her code. This allows you to leave a series of personalized messages for callers. The caller can also leave a message on the system. You can monitor this traffic from a remote location and even change the personalized messages. This would be an excellent method of controlling a field sales or service force, for example.

Another appealing wrinkle is Watson's ability to specify the time of day or date for which the card's phone number is valid. By entering several cards for one person (giving each the same ID code), the phone number Watson dials automatically differs based on day of the week or time of day. This is great for reaching a party at the office during business hours or at home during the evening and on weekends.

A sort of cross-linkage method can be used to employ MCI, SPRINT, or another alternate long-distance carrier. For example, you can create an MCI card containing the local access number and your MCI account code. If the phone number on an individual's card is then entered as "MCI#," followed by the person's phone number, Watson will use MCI for the call.

Finally, you can store additional information on the lower three lines of a card and you can even add a speech message. The speech message would be useful for storing unusual pronunciation or other data not easily shown in text.

Dialing an outgoing call can be accomplished in several ways. The phone connected to the Watson can be used normally. The keyboard can be used for manual dialing by holding down the Alt key and hitting the numbers on the top row (pressing ScrollLock does the same thing without the need to hold down the Alt key) while pressing both the ScrollLock and NumLock keys lets you use the numeric keypad for dialing. Automatic dialing is started by pressing F5 to dial the phone number on the current card. Watson indicates when the connection is complete and you should pick up the handset. You can also specify the name or ID code to be dialed. Watson can dial a number repeatedly until the call is answered, but using the line manually terminates this auto-redialing.

OUTGOING AND INCOMING MESSAGES

Watson can perform the functions normally assigned to a conventional answering machine. You can record an outgoing message used for normal incoming calls. If you don't record one, Watson uses its voice synthesis facility to answer with the message, "Hello. We cannot come to the phone now. Please leave a message after the beep. Thank you." The synthesized message is a pleasant male-sounding voice of very high quality; most callers would not be able to discern that the speech was synthesized rather than recorded on tape.

Recording a custom outgoing message is extremely easy. You simply speak into the handset, and the message is recorded on disk. It can just as easily be played back through the handset. In addition to the standard message, a personalized message can be left for callers who have had ID codes assigned to them. The same message can be left for several ID callers, or more than one message can be left for one caller (Watson plays them back sequentially to the caller). Watson can even record incoming calls that have been answered by a person.

Normally, incoming calls are recorded to disk for later playback. A card is opened for each incoming call, and the card indicates the time and date of the call as well as either the ID code (if the caller provided one) or "unknown caller." Since speech can occupy vast amounts of disk space (even in high-compression mode), Watson allows you to specify the maximum duration of an incoming message. If no limit is set, callers can talk for as long as they want, subject to available disk space.

THE CALENDAR AND DICTATION

Watson's calendar system includes an on-screen calendar to specify appointment dates, which you can also type manually. The cursor-control keys can move around the calendar from day to day and month to month. User-selected symbols indicate important appointments, and you can tell Watson to alert you with an audible alarm when an appointment occurs. Watson can even forward alarms to a specified phone number to inform you of appointments even when you're not at your desk. It also handles appointments recurring on a daily, weekly, monthly, or yearly basis.

Dictation cards are designed to hold memos, letters, and other speech. They function like other Watson cards in most respects.

SPEECH EDITING

All speech digitized and stored by Watson is manipulated in the same manner. The system is designed to act very much like a conventional tape recorder. As speech is being recorded, a tape counter is displayed on the status line. This indicates the number of seconds of speech entered. The gray plus and minus keys at the right end of the PC's numeric keypad function as fast-forward and rewind controls. Speech can be added at any point and can be inserted into the speech segment or overwrite the existing speech. Marks can be specified to identify the beginning and end of a segment of speech. A marked segment can be deleted, copied, or moved.

(continued)

Watson's connection scheme allows you to plug in a normal telephone, which can be used even when the computer is turned off.

If these sound like traditional word processing functions, the resemblance is not accidental. Watson allows manipulation of stored speech just as a word processor allows manipulation of text. Careful use of the speech editing facilities can result in finished dictation suitable for transcription.

TOUCH-TONE CONTROL

Almost all Watson functions can be called either with a command or with Touch-Tone sequences. The Touch-Tones can be issued from the telephone attached to Watson, a useful feature if a program is executing under Watson's time-sharing mode and also from a remote telephone. To control Watson from a remote phone, you enter a special owner's code defined with the configuration option.

Since the Touch-Tone sequences recognized by the system are complex and a remote user doesn't have the benefit of the on-screen help, the system synthesizes all the help messages that Watson would normally display on the screen. The spoken help can be interrupted once the needed reminder is obtained to shorten the process.

Remote access allows you to listen to incoming messages, record new outgoing messages (either for everyone or for the callers with assigned ID codes), and so on. A Watson owner can monitor messages and control subsequent callers from practically anywhere.

RUNNING DOS PROGRAMS

Watson offers two ways to use other programs from the Watson environment. The simplest involves invoking the DOS program from Watson. In this case, Watson is basically inactive while the DOS program is running. None of its advanced features are available, but the attached phone is connected to the phone line for normal operation. When the DOS program terminates, Watson resumes immediately. Alternatively, you can switch back and forth between Watson and the DOS program, although the manual indicates that this may not work with all DOS programs. This mechanism is bulky and almost unworkable in a floppy-based system, but it is viable with a hard disk.

Almost all Watson functions can be called either with a command or with Touch-Tone sequences.

Watson can also operate in a time-sharing mode that allows both Watson and a DOS program to be active simultaneously. This mode will probably cause the DOS program to slow down a bit, and it requires Watson commands to be issued only in Touch-Tone sequences.

BILLING AND COMMUNICATIONS

Watson includes a method of tracking expenditures or time spent on a project. The system works by requesting an account number and numeric amount when a function key is pressed. Watson then records the number of minutes since the last such operation, recording the amount of time spent as well as the amount entered (if any).

The time/billing data is not stored in a card file as the other Watson data is, but rather in a special file in DIF interchange format. Each entry includes four values: date/time, account, elapsed minutes, and value. The Watson manual includes the key sequences for *1-2-3* to load the Watson data file for collation and further manipulation.

Watson also includes a built-in 1200/300-baud modem based on a module from a Cermatek modem. It appears to share the de facto standard Hayes Smartmodem command set, but it is intended to be used with a specially modified version of the popular *PC-TALK* program supplied by Natural Microsystems. *PC-TALK* has achieved great popularity in the PC telecommunications game because of its low price and reasonable functionality. *PC-TALK* is not quite the same league as *CROSSTALK* or *Smartcom*, but it is a good performer in most respects.

The Watson version of *PC-TALK* looks almost exactly like the commonly distributed version. Its command syntax is very different from Watson's normal user interface, which could be troublesome to some users. *PC-TALK* maintains its own directory of phone numbers, unrelated to Watson's card files, but you can set up special Watson cards to invoke the modem program, call the number stored on the card, and sign on if the appropriate information is available. This is an improvement over normal *PC-TALK* procedures.

PERFORMANCE

While all the Watson functions sound bewildering, the system is remarkably easy to use, especially installation and the speech recording and playback functions. Speech quality was dependent on the compression used, as would be expected. Low-compression recordings were somewhat more natural than recordings done in the high-compression mode, but either recording mode resulted in more than acceptable speech quality. Both modes suffered from obtrusive noise bursts or loud clicks every couple of seconds. Overall, the recordings sounded like they were made on a moderate-fidelity cassette recorder. Watson's synthesized prompt messages are very good, much better than

those you can record yourself.

The trade-off between maximum quality and disk storage requirements is dramatic. My standard 14-second outgoing message resulted in a disk file of about 19K in the high-compression mode and nearly 50K in low-compression. Storing a large number of speech segments makes a hard disk almost mandatory even with high compression. I finally settled on low compression for my outgoing message and high compression for everything else.

Recording personalized messages, dictation, and other speech was very straightforward. The Watson function keys are reasonably easy to use, especially with the help screens displayed. Inserting, cutting, and pasting speech segments proved easy and effective. The analogy to word processing is accurate, and it proved both fun and useful to edit speech.

Watson's Rolodex-like visual interface quickly became comfortable to use. The system responds quickly to all commands, and it's simple to locate desired cards or move from card file to card file. The calendar functions were also helpful and easy to use.

I did have problems with Watson, however. Switching back and forth between DOS programs and Watson was possible only with some programs. *WordStar* and *dBASE III* worked reasonably well (although the Backspace key did not delete characters in *WordStar*, as it usually does, and the cursor retained its nonstandard appearance), but Microsoft's *Word*, for example, did not operate correctly. The mouse didn't work (the mouse driver resides in high memory and may not have been relocated correctly with Watson resident), and an attempt to switch back to Watson totally hung the computer, requiring a cold reboot to recover. *Microsoft Word* is my acid test for such matters, as it is almost impossible to get it working correctly with memory partitioning or time-sharing schemes. Watson's failure to handle *WordStar* correctly also has illustrious company.

I obtained similar results with the Watson time-sharing mode. *WordStar*'s performance was visibly degraded in the time-sharing mode, but not so much as to cause major difficulties. Watson's manual indicates that time-sharing is primarily intended for transcribing dictated speech, and it is clearly adequate for this purpose, but I'm not convinced that Watson's software is really usable in a day-to-day time-sharing mode. If time-sharing or switching isn't used, the primary benefits of Watson become unavailable.

While all the Watson functions sound bewildering, the system is remarkably easy to use.

I also had trouble with Watson's onboard modem. The modem and modified *PC-TALK* software worked well at 300 baud (although lacking an audible indication of the connection process), but I could not get the 1200-baud connection to work. Given its apparent Smartmodem command set compatibility, I tried to access the Watson modem with other popular modem programs such as *Smartcom* and *CROSSTALK*, but I was unable to do so.

Other than these difficulties, Watson performed as advertised. It is an exciting and innovative product, although other voice management products for the PC will no doubt begin appearing soon. Its voice store and forward and other voice management functions are truly useful, and Watson makes a superb (albeit expensive) answering machine. Its software is very nicely done, even considering the absence of a notepad or calculator. The documentation is first rate, beautifully typeset, and nicely tabbed for easy reference, with a good glossary and index.

My sample Watson was an early production model, and perhaps some of the kinks I experienced will be worked out in later versions. Overall, Watson represents a glimpse into the future of the marriage between microcomputing and telecommunications.

CYGNET COSYSTEM TELEPHONE SYSTEM

The Cygnet CoSystem is a flexible hardware/software package that adds sophistication and convenience to desktop telecommunications. It consists of an intelligent telephone, a phone-number directory, a high-speed modem, an automatic dialer, an appointment manager, an electronic mail system, a project manager, a cost accountant, and more. It seamlessly integrates with a PC and takes full advantage of the computer's power, but can perform many of its advanced functions even when the PC is off. The hardware is built like a tank, and the software is equally solid and sophisticated. You have to pay for this quality, but the CoSystem is fairly priced for what it delivers.

Installing the CoSystem is very straightforward. The system connects to the PC's COM1: or COM2: serial port via a normal serial cable. Two phone lines can be connected with a pair of standard RJ-11 modular plugs or a two-line RJ-14 plug. The *COSYSTEM* master program checks the integrity of the CoSystem-PC connection, and a fascinating diagnostic program checks the CoSystem's internal memory, the connections to the phone system, and

other aspects of the unit's operation. You'll probably want to put the *COSYSTEM* program in your AUTOEXEC.BAT startup file so the CoSystem is melded into the system everytime you boot your computer.

Cygnet supplies a configuration program to match the CoSystem to its environment. You specify whether each of the two lines is connected to an office PBX or to a central office, a private, or a Centrex line; whether Touch-Tone or rotary dialing should be used; if data transmissions will be received on either of the two lines, and if so, what delay the CoSystem should use before answering. The duration of a hook flash (used to signal PBX systems), the ring pitch and duration for each line, recognition of the various disconnect signals sent by different phone systems, and other variables can also be set. Finally, you can enable a "communications management" system.

Up to 15 access routes can be specified for each line. An access route is the call-placing procedure consisting, for example, of having the CoSystem dial a digit, wait for dial tone, dial another digit sequence, dial either seven numbers for a local call or ten for a long distance call. These provisions allow you to use it with almost any corporate or home phone system. Significantly, the CoSystem actually recognizes intermediate dial tones when PBX or Sprint/MCI-type long distance carriers are used; it does not merely pause and assume that a dial tone will be present after the delay.

The configuration utility also allows the system to retain your name and phone number for use with the *Electronic Mail* program. A password can lock specified keys and prevent examination of communications management information. Finally, the CoSystem retains the date and time in its memory, and updates the PC during boot-up.

The heavy-duty CoSystem phone itself weighs 12 pounds, and the 40 light-touch buttons are obviously sturdy. The handset is solid, a large speaker provides good fidelity, two volume controls adjust ring and speaker level, and 21 LEDs indicate operating status. The panel that covers the button labels is held on by strong magnets, and Cygnet provides press-on labels, numbers, and letters to customize the labels. The overall feel is highly professional, much better than even Western Electric equipment (not to mention some of the low-priced junk now on the market).

Cygnet's on-screen presentation is well integrated into the PC environment, with highlighting, the cursor and function keys, and other PC features.

AN INTELLIGENT PHONE

The CoSystem acts as an advanced electronic telephone even when the PC it's connected to is off. Making a call is as simple as picking up the handset or hitting the speaker key. The CoSystem chooses the first available line for the call, or you can hit the line 1 or line 2 buttons to choose a specific line. If the optional speaker-phone attachment is connected, merely hitting line 1 or line 2 takes the system off-hook for dialing.

LEDs indicate the status of each line. The LEDs blink once every 2 seconds when a voice call is in progress, two times a second when a call is on hold, very rapidly during data transmission, and are on continuously when another phone is using the line. LEDs also indicate the selection of the phone's special features.

If the dialed number is busy, the "last no" button redials it once. Hitting the "redial" button dials the number every 20 seconds for 15 minutes and every 2 minutes thereafter for 45 minutes. You can still use the line doing the redialing for incoming or outgoing calls; the CoSystem merely resumes redialing when the line is clear.

The CoSystem sets up three-party conference calls using both lines. When you reach the first party, you can put them on hold and manually dial the second party, or the CoSystem can automatically dial the second party while the first conversation continues. If all three parties are CoSystem users, a special voice and data conference call can be made.

You can program 12 of the CoSystem keys with one primary and two alternate sequences, yielding a total of 36. A sequence can be an individual phone number, an access route, or even a complete database log-on procedure. The 12 primary programmable key sequences are stored in the CoSystem's memory, so they will work even if the PC is off; the other 24 sequences require an operating PC.

PHONE DIRECTORY

Cygnet's *PHDIR* program controls the entry of information on up to 400 phone numbers. You supply the last name, the first name (or company name), one or two voice numbers, and a data number. An index and a mail distribution list category group listings for easy retrieval, and the mail list feature can create mailing lists with one or two keystrokes. *PHDIR* acts like a customized database, with provisions to add, edit, delete, view, print, and otherwise manipulate the phone data. The on-screen presentation is well integrated into the PC environment, with highlighting, the cursor and function keys, and other PC features in an elegant manner.

Once phone numbers have been en-

tered with *PHDIR*, hitting the CoSystem "dir" button displays a list of 30 numbers specified as most often dialed. Any program executing when the "dir" key is pressed is "bookmarked" (to use Cygnet's terminology) and resumes when "dir" is pressed again. Cygnet does not use commercial memory partitioning programs such as *Memory Shift* to accomplish this; its own software handles the background processing through interrupts.

Once the directory is displayed, hitting the two-digit code next to each entry automatically dials the number. These common numbers are also downloaded to the CoSystem. Hitting the "speed" button lights an LED next to the "enter number" sign, and you can then enter the two-digit sequence directly on the CoSystem's keypad. Of course, this requires memorizing the codes, but Cygnet points out that it isn't hard to remember two-digit codes for commonly dialed numbers.

If the number you want isn't on the initial screen, you can type a character or two and the system will search for matching names and numbers. For example, entering MI would bring up all the numbers for last names or companies starting with those two characters. You can also search by directory index, if you grouped your entries that way. Once the desired number is located, the CoSystem automatically dials it. If the number is busy, you can use the automatic redialing feature. If the busy number is another CoSystem, you can even leave an electronic mail message.

AN APPOINTMENT CALENDAR

The Cygnet *CAL* program has excellent appointment-calendar features. *CAL* is designed to be run when the PC is first started each day; the CoSystem beeps and lights the "calendar" button to remind you to check your appointments.

You make calendar entries using the *CAL* program. Two types of entries are allowed: appointments, which can be meetings or phone calls and reminders. Events can be one-time occurrences or recurring entries such as regular meetings, birthdays, and so on. The program asks if the directory should be used in conjunction with a meeting. If so, the relevant phone number is included with the appointment notice and the CoSystem can be instructed to dial the number at the designated time. *CAL* has provisions for adding, deleting, or moving entries.

Hitting the CAL button on the CoSystem interrupts any executing program and displays a screen showing the appointments and reminders for the day and any reminders for the following day. Function keys can be used to display a calendar for the full month, showing days that have been "blocked" by holidays or vacations and little boxes indicating how many appointments have been booked for each day of the month. The cursor keys move you from day to day, and you can go immediately to any specific date. *CAL* also displays a calendar for the first or last 6 month period of the current year.

When the time comes for an appointment, the CoSystem beeps and displays the calendar screen. If a phone number is part of the appointment note, the CoSystem can dial the number automatically. This is very handy when you need to make calls at specified times.

ELECTRONIC MAIL

The CoSystem uses its built-in 300-baud or 1200/300-baud modem in unusual and creative ways. Its communications capabilities depend on whether the unit is talking to another Cygnet CoSystem or to some other system.

Communicating to remote CoSystems enables various powerful and unusual options. Both incoming and outgoing electronic mail can be processed automatically whether the PCs on either end are on or off. If you have entered electronic mail groupings in the directory, you can automatically send correspondence to the entire group. "Carbon copies" can be sent with normal mail as well.

CoSystem mail consists of a standard text document and, if desired, up to 15 text or binary program files as "attachments." The main documents must be prepared with a simple editor invoked when you press the "mail" button. While not a full-blown word processor, this editor has

Cygnet CoSystem includes an intelligent telephone that can perform many advanced functions when the PC is off.

word wrap and uses the PC's cursor control, Backspace, Ins, and Del keys for editing. It's quite sufficient for short letters and memos. One nice feature of the CoSystem's editor is that the memo heading is filled out with the name of the recipient and sender and the date; you enter only the subject of the memo. Once the document has been entered, the software asks whether there are any attachment files; if the document should be labelled as "confidential," in which case a password is required for the recipient to read it; and when to send the mail (immediately, delayed to a time you specify, or when manually started).

The mail system has three "trays." The "incoming" and "outgoing" trays hold messages that have arrived or are waiting to be sent, while the "hold" tray stores mail for filing on disk, erasure, or transmission to other parties. The system shows the status of transmitted messages, that is, whether they were received or not, if there was no answer at the receiving end, and so on.

Cygnet also supplies an advanced electronic mail program called *EMAIL*. It works much like the already advanced standard mail program except that it enhances unattended processing and keeps permanent files and records of mail activity on disk. This storage allows transmission and reception of large amounts of data (more than could be retained in the approximately 52K bytes of available memory in the CoSystem unit). Given the disk-oriented nature of the advanced *EMAIL* program, the PC must be on during processing, which is not necessary for normal mail communications.

The CoSystem has many other telecommunications features as well. Teleconferencing involves both voice and data communications. This feature can be very useful for transferring data, spreadsheets, and other computer information while discussing it verbally. With one line, the CoSystem automatically interleaves voice and data communications, but using two lines enables simultaneous voice and data communications. The CoSystem automatically interleaves voice and data in a three-party, two-line conversation.

The Cygnet software can also manage the full logon sequence to establish contact with commercial database services.

The CoSystem modem also supports more traditional communications with mainframes, other personal computers, and commercial data services. Up to 15 "terminal profiles" can be defined, each of which sets the parameters the CoSystem will use for a connection. The parameters include baud rate, number of data bits, parity, number of stop bits, end-of-line characters to be sent and received, whether auto line feeds should be added, local or host echoing, whether the X-on/X-off protocol is recognized, and what characters should be ignored when received from the host. The CoSystem can also operate in "auto-answer" mode using a selected terminal profile.

The Cygnet software can also manage the full logon sequence to establish contact with commercial database services. The last few characters of the prompt from the host are specified, as is the response that would normally be typed on the PC. Using this system, it would even be possible to dial, logon, request selected stock quotations, and log off from Dow Jones, all by pressing one programmable CoSystem button! Cygnet also supplies a program called *TERM* for printing data as it is communicated or for sending or receiving data from or to disk files. *TERM* includes no error-checking protocols as *Xmodem* does, so you can't use the Cygnet software with bulletin boards or other services that require error-checking protocols.

While the standard *TERM* communications software provided by Cygnet works well, it is no match for PC communications programs such as *CROSSTALK*, *Smartcom*, *PC-TALK*, *AMCALL*, and *Perfect Link*. Since a purchaser of a CoSystem is not likely to want to buy a Hayes Smartmodem as well, Cygnet also includes a Hayes emulation program that can be downloaded from the PC to the CoSystem. This allows the CoSystem modem to run with any commercial modem software designed for the Hayes modem operating codes.

COMMUNICATIONS SYSTEM

The Cygnet software package includes a "communications management system" that tracks all of the outgoing and incoming voice or data calls as well as electronic mail. Up to 200 records are stored in memory and up to 10,000 on disk. The date, start time, duration, access route, type, phone number, account number, and party called are logged automatically. The party called is pulled from the phone directory if the call uses the directory. The account number is a four-digit code that you are able to assign to projects of your own devising. Hitting the "account" button on the CoSystem records the time spent on projects allowing the communications management system to be used for project timing as well as tracking communication activity.

The system produces six basic reports: a type report listing records in chronological order by type, a report of activity on a specific account, a report of all activity for a single party or customer, an access route report useful in determining usage of a special long distance carrier, a straight chronological activity report, and a gener-

al report that produces user-defined reports. Four types of statistical reports show summary statistics and bar charts of activity by type, account, customer, or access route.

PERFORMANCE

How well does all this work? In a word, beautifully. The CoSystem is a complex piece of hardware, and the software is comprehensive, but both aspects are so well engineered that their operation is almost intuitive. I have rarely seen better integration into the PC environment. The CoSystem itself seems a natural extension of the computer (even though it works well when the PC isn't on). While I wouldn't say you could use the system without looking at the documentation, it is easy to figure out what is happening without referring to the manuals. Everything does what you would expect it to, without undue complications or difficulties. About the only things missing are a calculator and a notepad, facilities often provided with background desktop accessory software.

The manuals are up to the standards set by the rest of the system. Eight short booklets cover each of the main operating programs. While all eight could have been combined into one, the individual manuals are easy to assimilate and comfortable to handle. Although produced on a word processor and not typeset, they are very legible, clearly written, and include sample screens when necessary.

Voice quality is exceptionally good through both the handset and the optional speakerphone attachment. I assumed that the mediocre audio quality of most phone conversations was due to the line, but the unusual clarity of conversations held on the CoSystem seems to indicate that the instrument plays a large role as well. The speakerphone is especially notable; this is the first such device I have used where I have received no comments from the other end complaining about an echo effect. Sensitivity is very high, but background noise is held to a minimum.

The feel of the handset, panel switches, and overall construction of the CoSystem is exemplary. The unit has the wonderful heft of audiophile stereo equipment or a professional camera. Considering how much time you spend using the phone, the pleasure you get from the quality of the CoSystem is important.

The feel of the handset, panel switches, and overall construction of the CoSystem is exemplary. The unit has the wonderful heft of audiophile stereo equipment.

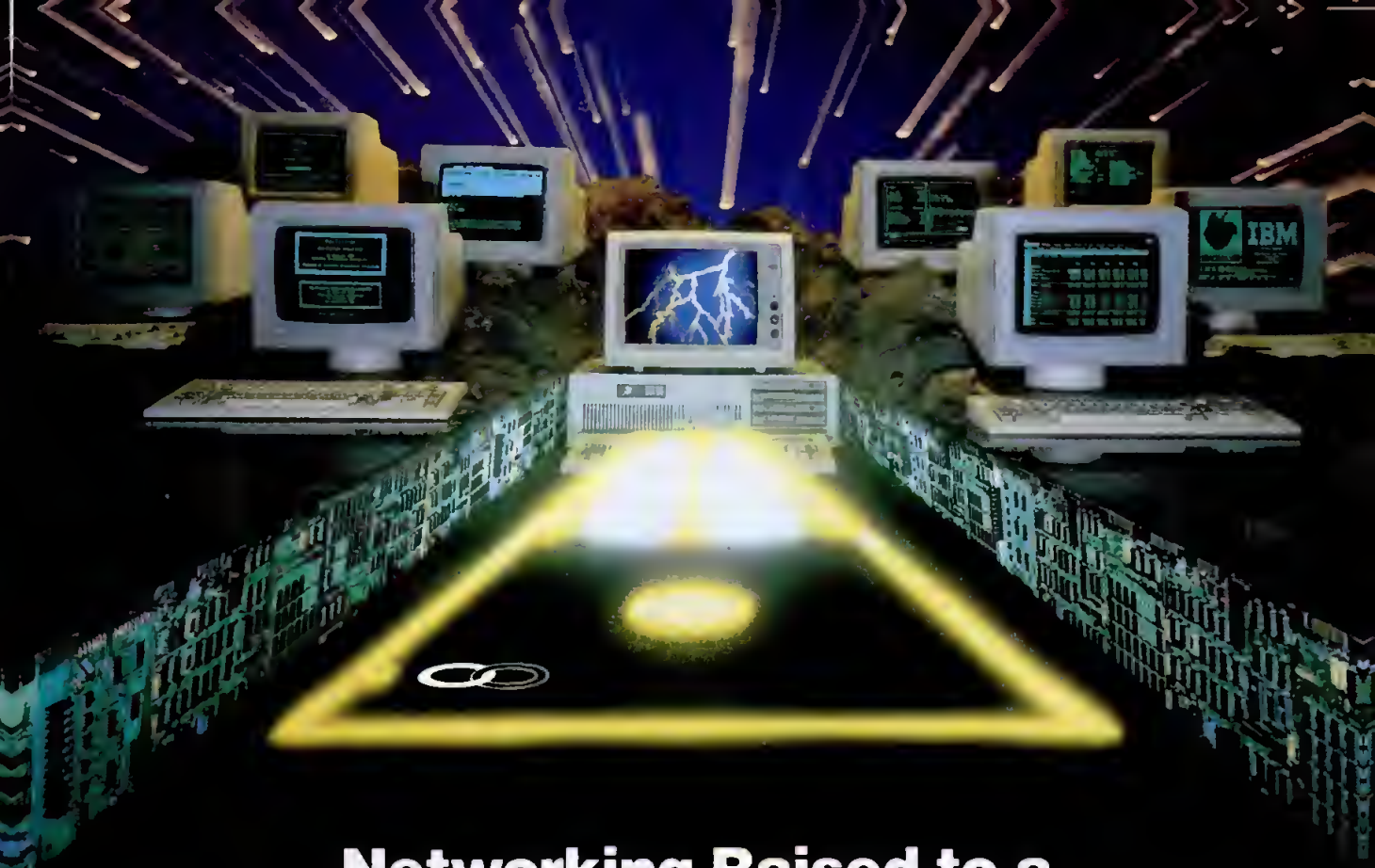
The CoSystem hardware and the various Cygnet software programs worked exactly as claimed. The background feature worked well with almost every program tested. As is often the case, *Microsoft Word* was the only program that would not allow access to the Cygnet software from the CoSystem keyboard (one would certainly think that the authors of DOS would obey the rules of their own operating system!). Applications programs such as *Wordstar*, *dBASE II* and *III*, Lotus's *1-2-3*, and many others worked without a hitch.

The Hayes Smartmodem emulation program also worked perfectly. You can specify which line to use for outgoing and incoming modem calls and you can even set software "switches" to mimic the physical switches in an actual Hayes modem. The emulation program can be retained in the memory of the CoSystem, saving the 45 seconds or so the program takes to load but consuming about 10K of the internal CoSystem memory. *Smartcom*, *CROSSTALK XVI*, *PC-TALK*, and other modem programs operated with no problems whatsoever. In every case, the CoSystem acted exactly as a Smartmodem would in the same situation, down to the same speaker sounds produced during dialing and the same on-screen messages.

The CoSystem is, to say the least, not inexpensive. The 300-baud version costs $1,495, and the 1200/300-baud version goes for $1,895. The optional speaker phone attachment adds another $150 to that price. Cygnet has clearly targeted the corporate business market rather than home users. The CoSystem is especially useful in communicating with other CoSystems, so the electronic mail provisions are geared for corporate CoSystem networks. To many such corporate users, the CoSystem's price will be well justified by improved productivity and overall savings accrued by convenient, unattended nighttime communications.

The CoSystem certainly isn't perfect. The need to run *CAL* to update the day's appointments when the system is booted interrupts smooth execution of AUTOEXEC.BAT; if *CAL* isn't run, the CoSystem beeps raucously. Cygnet should make this beep optional; I can imagine an office first thing in the morning sounding something like an electronic aviary. And the CoSystem doesn't have voice synthesis, store and forward, or other advanced digital voice capabilities. Its electronic mail facilities are truly useful only in a network of CoSystems. But what the CoSystem does have is the absolutely best phone system/personal computer interface I have ever seen.

Reviewers can get jaded by the profusion of riches that crosses our paths. Sometimes it bothers me that it's so difficult to get excited about new hardware and software systems. Fortunately, this was *not* a problem with the CoSystem. To put it mildly, the Cygnet CoSystem is an absolutely terrific product. ■



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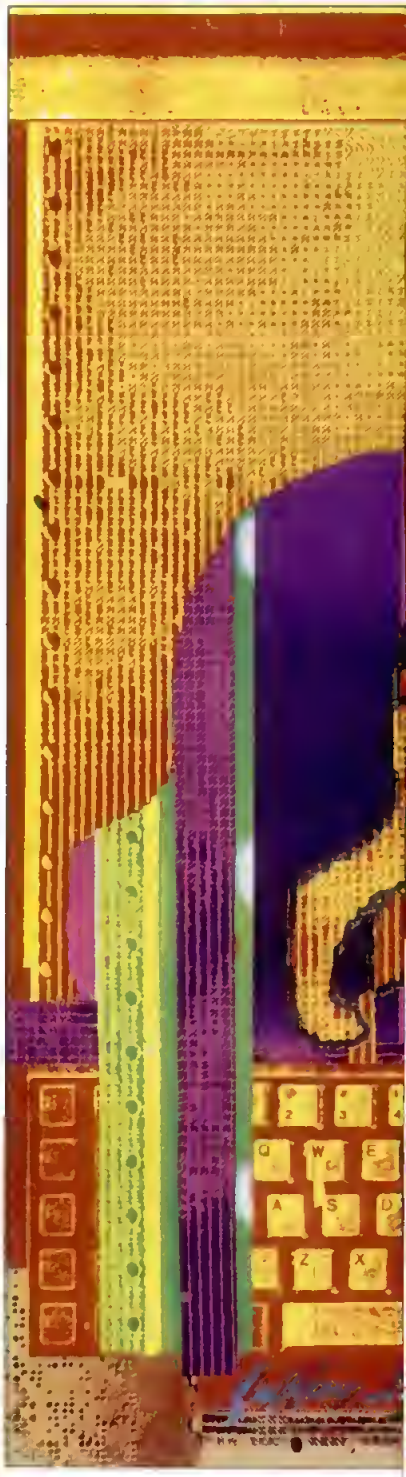


TRY THIS: POWER UP YOUR PC AND BOOT UP *WordStar* or some other word processing program. Then close your eyes and try to type a letter.

You're a near-perfect typist and know your word processing program like the back of your hand. But the capabilities of the software go largely to waste. You

Freedom I offers new independence to the blind, enabling them to bank by computer, subscribe to on-line services—in short, to use personal computers for applications that were inaccessible to them before.

Illustration: Jeffrey Schiller

can't see what's on the screen. The same goes for spreadsheets, databases, and virtually any other kind of program. You're one of the approximately 1 million blind or visually impaired Americans.

Until recently, the PC was effectively beyond the reach of the blind and visually impaired who can't afford special talking terminals costing several thousand dollars apiece.

Now, however, the blind and others with greatly restricted vision can take advantage of the PC at reasonably low cost, thanks to software packages that "read out" on-screen text through a voice synthesizer. One of the newest of these packages is *Freedom 1*, developed by Interface Systems International of Portland, Oregon.

NEW INDEPENDENCE

Freedom 1 offers new independence to the blind, enabling them to bank by computer, subscribe to on-line services—in short, to use personal computers for hundreds of applications that were inaccessible to them before.

Freedom 1 essentially gives sightless PC users the same information-handling powers that a person with normal vision has. Besides reading out text that appears on-screen, the program tells the user what operations are under way, from deleting a letter to searching for a specific word. The system signs on with a cheerful "Hello" and signs off with a pleasant "Bye" and can vocalize in understandable English virtually anything—both input and output—that appears on the screen.

Freedom 1

essentially gives sightless PC users the same information-handling powers that a person with normal vision has.

The software, which is delivered on a standard floppy disk, will run on systems that use MS-DOS 1.25 or later (including PC-DOS). A CP/M version is available as well.

To use *Freedom 1*, the user simply runs it before using other applications so that it is copied into memory. Alternatively, the programs can be copied onto each applications disk or saved to a hard disk.

Freedom 1 was written for the Votrax voice synthesizer and works best with it. The Votrax requires no modifications, such as special synthesizer boards, to operate with the PC.

Yet Ned Johnson, president of Interface Systems and inventor of *Freedom 1*, emphasizes how independent it is of particular brands of hardware and software. "We tried to make it as powerful and comprehensive as possible," says Johnson. In fact, *Freedom 1* can operate with almost any package because it does not interact with the software directly. Instead, it takes information from the monitor screen, including cursor positioning, and directs it to the Votrax, which analyzes the text and synthesizes speech from it. With telecommunications accessories, it enables a sight-impaired person to communicate with others via any of the on-line services, such as The Source, and to access a wide range of information services, from news and stock reports to user group bulletin boards.

The program is so easy to master that many users pick it up in only a few minutes.

Freedom 1's $500 price makes it affordable for individuals as well as companies and government agencies with vision-impaired employees. Thus, *Freedom 1* is opening previously unimaginable possibilities of employment—including self-employment—for sightless persons who may have been practically shut out of the job market.

The upshot of all this is a bonanza for persons with restricted vision, plus a new, previously closed market for PCs and PC-compatible software.

"THIS IS A TEST ..."

"There has been a dearth of high-quality software for applications such as this," Johnson explained while preparing to put *Freedom 1* through its paces at a demonstration last July.

When the system was set up, Johnson typed this sentence: "This is a test of the Freedom I."

Freedom 1 started to speak: "*This is a test. . . .*" The words were clearly understandable. I closed my eyes and had no trouble following what was being read off the screen.

The system spoke in a bland, neutral tone, but Johnson points out that the Votrax has 3.5K of memory so the pitch and volume can be programmed to express a distinctive voice—masculine, feminine, or even robotic.

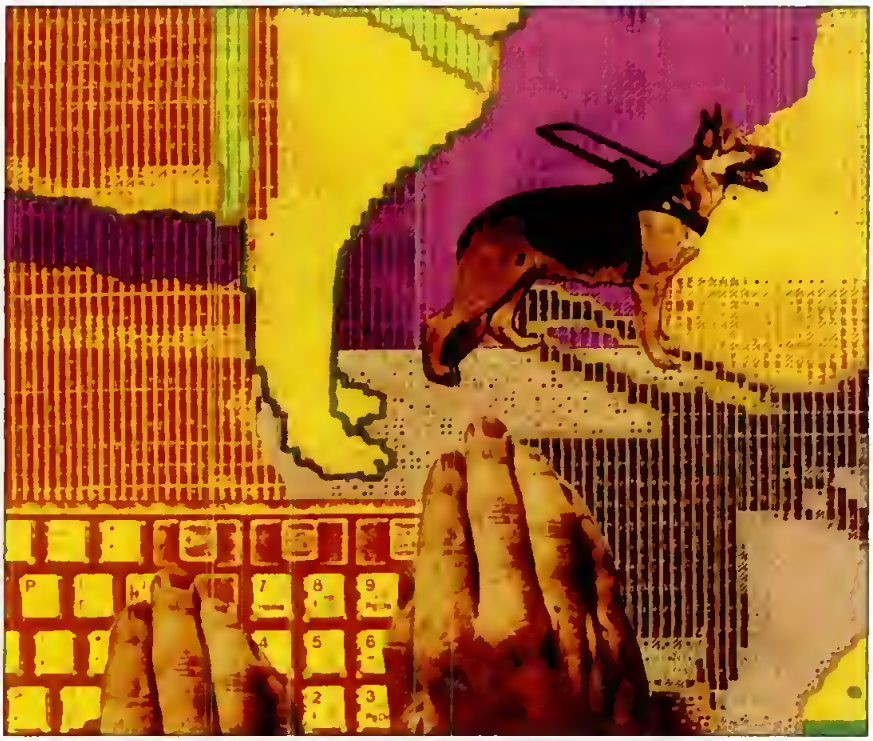
While the machine was speaking, Johnson pointed out some of *Freedom 1*'s other capabilities.

"It can distinguish capitals," he said, and promptly shifted into the proper mode

PAGE ONE

Freedom 1
Interface Systems International
P.O. Box 3289
Portland, OR 97208
(503) 256-3214
List Price: $500
Requires: 64K RAM, serial port, voice synthesizer.

CIRCLE 694 ON READER SERVICE CARD



with a stroke of a key.

Freedom 1 responded by spelling out the sentence it had just read: "*Capital T . . . capital H . . . capital I. . . .*"

"It will ignore or state punctuation," said Johnson.

"*Comma . . . comma . . . period,*" said *Freedom 1* as the cursor moved over punctuation marks.

Johnson continued, "It indicates spacing . . ."

"*Space, space, space.*"

" . . . and can read out numbers as individual digits . . ."

"*One, eight, one, six, zero.*"

" . . . or as words."

"*Eighteen thousand one hundred and sixty.*" *Freedom 1* can pronounce numbers through 999,999,999,999 as words—a feature that makes it useful for scientists, economists, or anyone who deals with numbers in the millions and billions.

"It can move whole words or individual characters right and left."

The program carried out these operations in cooperation with a word processing package. *Freedom 1* locates the word that needs to be moved or removed and announces its exact position on the screen—as "line twelve, column one," for instance—and the word processing program then can be used to do editing.

"And it tells you when you reach the end of a page," Johnson said.

"*End of page,*" said *Freedom 1*.

"A keyboard echo reads out letters as you type, and you can hit the Q key to shut it up," Johnson concluded.

He pressed the key, and *Freedom 1* fell silent. Most of the program's commands are carried out by a key bearing its initial letter, such as *Q* for *Quiet*.

Finally, Johnson demonstrated *Freedom 1*'s speed-reading capability. *Freedom 1* will read out text at three different speeds, from slow (75 words per minute) to fast (300 words per minute). The reading speed accelerates without an increase in pitch so that a rapid search will not sound like a Donald Duck imitation.

Freedom 1 can also:

- State exactly where the cursor is on a page.
- Put as many as 26 markers on the screen and return to them.
- Announce the status of switchable modes and functions (by saying "Punctuation on," for instance).
- Read character-by-character or word-by-word, either forward or backward.
- Pronounce nonprintable computer characters, such as "Carriage return."
- Set up two windows within a screen. This capability comes in handy when reading vertical columns, for example.
- Announce indentations, and tell precisely where the next keystroke will show up on the monitor.

Johnson stresses that even though *Freedom 1* was designed for maximum ease of learning and operation, he is still astounded when he sees how quickly users pick it up.

He recalled what happened on a recent business trip to Alaska. "There was a blind stenographer up there," he said. "I sat down with her and showed her how *Freedom 1* worked. After about an hour I said, 'Why don't you type a letter?' Then I went out for a cup of coffee.

"When I came back, she had typed 6 or 7 lines without my being there to tell her what to do. There were a few misspellings, but it was great! I didn't have to tell her what the errors were—only how to find and correct them."

Johnson also cites the case of a programmer in Texas who had been using a talking terminal but found he could work more efficiently with Interface Systems's software.

Even the first version of *Freedom 1* met with an enthusiastic response from experts in the field of reading aids for the blind. Johnson called up one such expert, a blind acquaintance who had been using the software with his home computer, and was about to apologize for the crudity and limitations of the program when the other man started praising Johnson's work.

"I've had this computer sitting here unused on my desk for months, like a big paperweight," he told Johnson. "Now I can use it, thanks to you." Along with

such encouragement came financial backing that enabled Johnson to produce the more versatile version that his firm is marketing today.

GETTING STARTED

Johnson started work on *Freedom 1* 5 years ago. He had a computer with a voice synthesizer, and a member of the Oregon Commission for the Blind suggested programming the voice output to echo whatever was on the screen.

It was plain to him that something like *Freedom 1* was needed. "Once I talked to a blind student who had taken a computer class," he recalls. "He couldn't see what was on the screen, and there was no voice output for him to follow. He could only listen to the conversation of the people around him. He learned, but it wasn't much fun."

Devising a suitable program was easier said than done, partly because synthesizers have trouble replicating roughly a dozen similar but distinct sounds in English speech, such as the fricatives "f" and "s"—sounds that involve delicate coordination of the tongue, lips, and teeth.

Johnson overcame those obstacles, however, and soon had a primitive version of *Freedom 1* operating. It used heuristic guidelines, or linguistic rules of thumb, to aid the machine in phonetic spelling.

The guidelines work roughly in the following manner. *Freedom 1* sends its output, in the form of ASCII characters, through a serial cable to the Votrax. The data pass into the buffer memory of the synthesizer, where a processor in the Votrax evaluates them to see if any of the words contain exceptions to the standard rules of English pronunciation. These exceptions are recorded in the synthesizer and matched with their proper pronunciations. Then the synthesizer proceeds to the words with standard pronunciations and works them out. The end result is a spoken word or sentence.

How does the system know which pronunciations are standard? The Votrax SC-01A chip holds a list of 64 phonemes, or speech sounds. Each phoneme is represented by a hexadecimal code and a phoneme symbol code. The *o* sound in *mop* for example, is symbolized by hexadecimal code 24 and phoneme symbol code AH, while the *o* sound in *cold* has the hexadecimal code 26 and the phoneme code O. These codes enable the Votrax to interpret the data sent to it by *Freedom 1*. This arrangement works so well that the present version of *Freedom 1* pronounces 90 to 95 percent of all words correctly.

Pitch can be programmed to express a distinctive voice—masculine, feminine, or even robotic.

Of course the *Freedom 1* has some limitations, as almost any system that uses a voice synthesizer does. For example, it has difficulty distinguishing between *i* and *y* sounds—it says "bit-ess" instead of "bytes." It also has trouble with words that are spelled the same but have different pronunciations. The present and past tenses of *read* are spelled identically but have dissimilar vowel sounds in them, for example. The computer isn't smart enough to figure out the appropriate pronunciaton in every case. Users have no choice but to get accustomed to these eccentricities of the system.

Freedom 1 users can get around many such difficulties with the help of a "personalized vocabulary." Part of the synthesizer's memory can store a list of words that require nonstandard pronunciations. The Votrax is alerted to those words when they appear subsequently.

To help users get used to *Freedom 1* as quickly and painlessly as possible, Interface Systems has taken pains to produce good documentation. The manual for *Freedom 1* comes in three formats—booklet, tape, and disk—for maximum convenience, and the high quality of the documentation compensates for *Freedom 1*'s lack of on-line help. Johnson considered building such help into the software but decided against it, partly because it would occupy too much memory and partly because he thought a good manual on tape would be more useful.

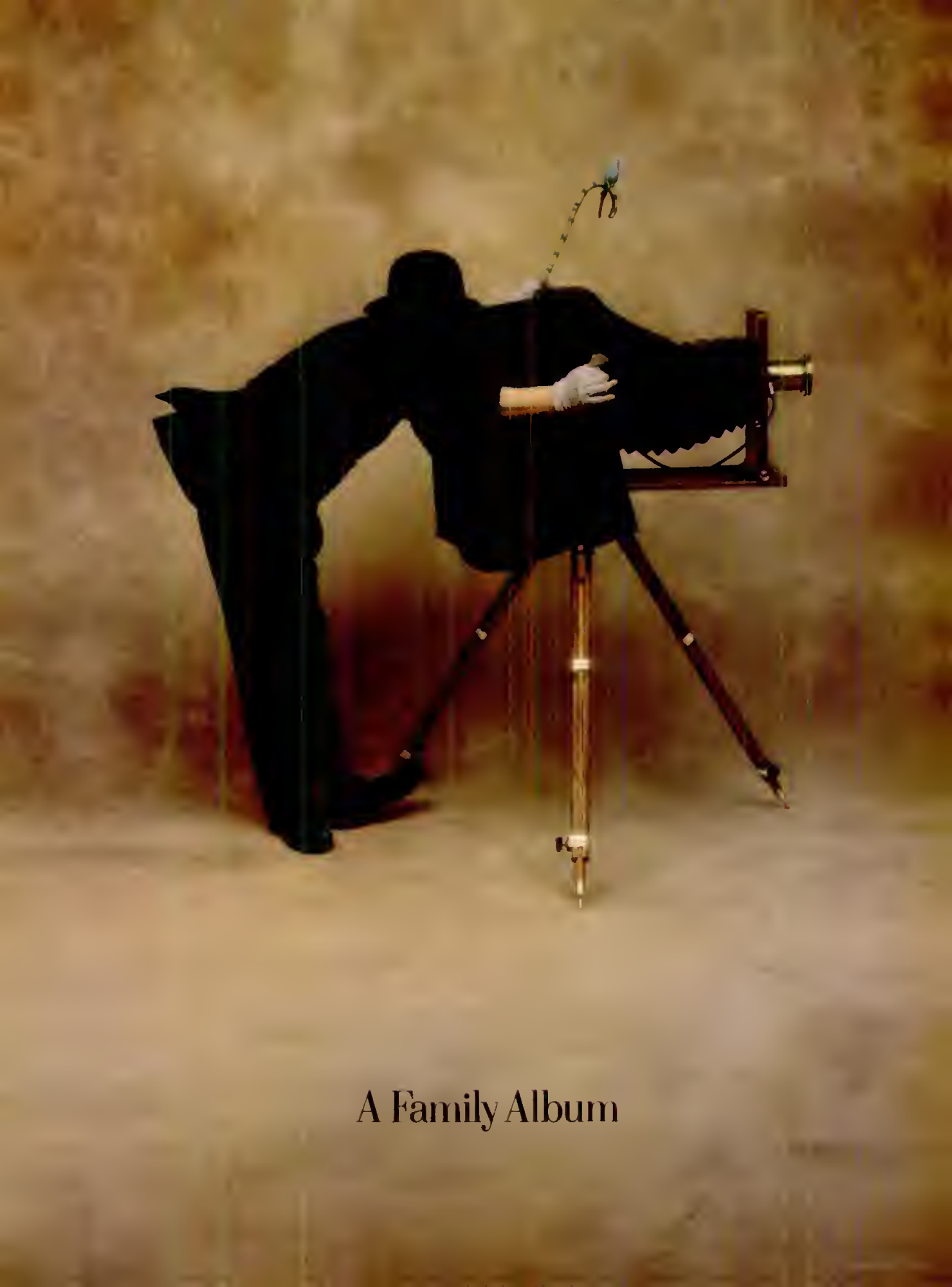
Systems like *Freedom 1* have only begun to tap the potential market for them. Similar software might be devised for other languages, for example.

Foreign languages might be easier to handle than English, because the notorious discrepancy between spelling and pronunciation in English makes ours an especially hard tongue for computers to learn to vocalize.

A given consonant or vowel in English can be pronounced in many different ways. The letter *c*, for example, can be either hard (as in *cat*) or soft (as in *cinnamon*), while *gh* can be pronounced like *g* (*ghost*) or *f* (*tough*). Some letters may have a dozen different pronunciations in everyday speech, depending on context.

Compare this with Spanish pronunciation, which is more closely correlated with spelling. A Spanish-language synthesizer would require far fewer and simpler guidelines than its English-speaking counterpart. For now, however, Interface Systems has no plans to branch out.

"Our market," Johnson says, "is the English-speaking world." That should be sufficient to keep Interface Systems—and PC users with restricted vision—busy for a while. ■



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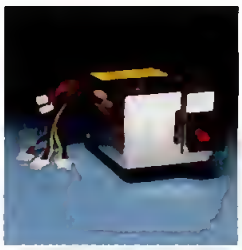

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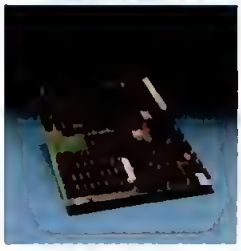

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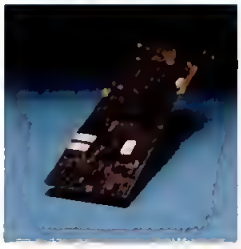

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Speaking Your Mind With MicroVox

Photograph: Les Morsillo

With A MICROVOX KIT, A FEW BASIC tools, and an elementary knowledge of mechanics and electronics, you can save dozens of dollars on digital diction—and even educate yourself along the way. To prove a point, we did it.

In a modern-day *Pygmalion*, Professor Henry Higgins would probably have exhausted his supply of both patience and candles trying to teach a PC Eliza to prattle intelligibly in the King's English. In reality, you're more likely to run out of cash first. And the expense is difficult to justify.

Most hardware and software add-ons are tax deductible as business expenses. You should only try to deduct a voice synthesizer, however, if you want to visit with an IRS auditor.

Money, obviously, is not the only motivation for buying a voice synthesizer. There is, after all, the romantic allure of digital diction. With a voice synthesizer, you can venture into almost unexplored areas of computing and just have fun. Were talking attachments more affordable, your mute microcomputer would now be exploding with electronic eloquence.

DISCOUNT DICTION

When I safaried into speech synthesis, I discovered a way to save one-third or more off the cost of computerized conversation. Just as in the more mundane realms of plumbing and carpentry, you can reap savings in personal computing by doing it yourself. You can build your own speech synthesizer.

You shouldn't tremble at the thought of dealing with some of modern technology's most sophisticated and delicate creations. If you, like most people, built your computer system from a variety of manufacturers' add-ons, you probably have enough innate talent and experience in the rudiments of do-it-yourself computing to take on the project. It's only a small step from handling circuit boards laden with parts to sliding the parts into sockets, and then only another small step to melting some lead to hold the sockets in place.

Beside the benefit of savings, assembling a voice synthesizer from a kit will show you how easy it is to build a computer component—and reveal how little there is to fear in the tangle of circuit traces inside your system unit.

Moreover, after you've finished the assembly, your solid-state voice hox is in itself an educational tool. With it, you gain knowledge about the up-and-coming technology of voice synthesis.

WEEKEND MECHANIC

In building a voice synthesizer—or any electronic project—the more of the work you do yourself, the more you'll save and the more you'll learn about the technology. If you feel up to the challenge, you can start at the same place most manufacturers do—with the fundamental integrated circuit chips. Then, armed with the hardware, you can go on to design and develop your own voice synthesizer.

Going that route, you can create a synthesizer for a total hardware cost of under $50 (with suitable parts-scavenging). A reasonable starting point is Radio Shack, from which you can buy a voice synthesizer chip, the SP0256-AL2, catalog number 276-1784, for a mere $12.95.

That price is but the tip of a vast project that could rip a titanic hole in your budget. Not only will you need to add support chips to get the voice chip to utter its first words, but you'll also need to figure out how to connect it with your PC. (If you've had problems dealing with a serial or parallel port, imagine the fun of designing one.)

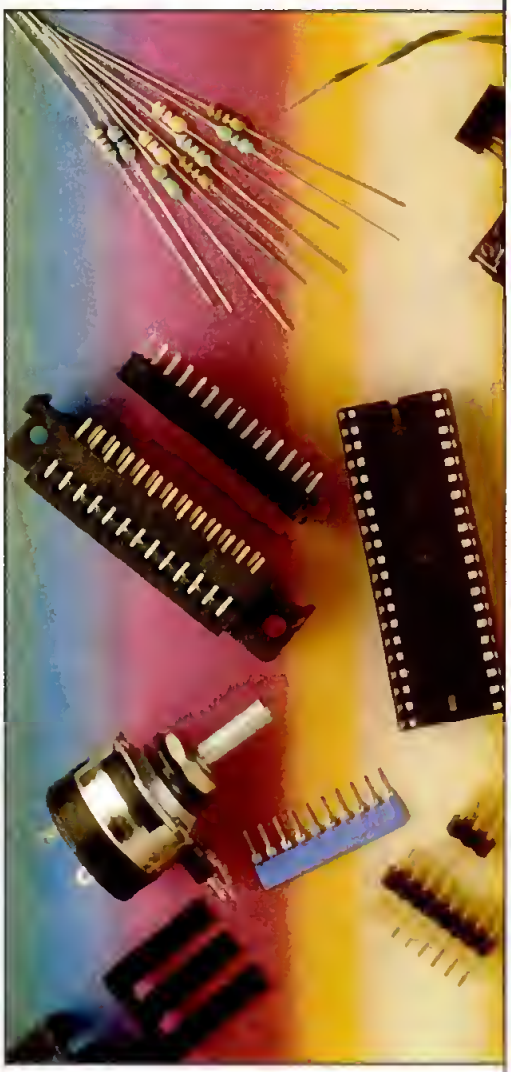
WHEN THE CHIPS ARE DOWN

If you add in the value of your time, the do-it-yourself savings diminish considerably. If you draw more than minimum wage, it's safe to assume you'll be losing by starting at the chip level.

A more moderate approach is to let someone else handle the design and development of circuitry as well as the task of rounding up all those hard-to-find microcircuits. Build a real kit.

The case in point, the MicroVox from Micromint, proves that if you have reasonable mechanical skills, a rudimentary knowledge of electronics (you know which end of a soldering iron to hold and can identify resistors, capacitors, and integrated circuits merely by examining them), and value your time at less than $40 per hour, you can save money by assembling a kit yourself and reap the more intangible benefits of pride and knowledge.

The MicroVox kit is expensive enough



MicroVox
Micromint Inc.
561 Willow Ave.
Cedarhurst, NY 11516
(800) 645-3479
(516) 374-6793
List Price: $269 (kit), $349 (assembled).

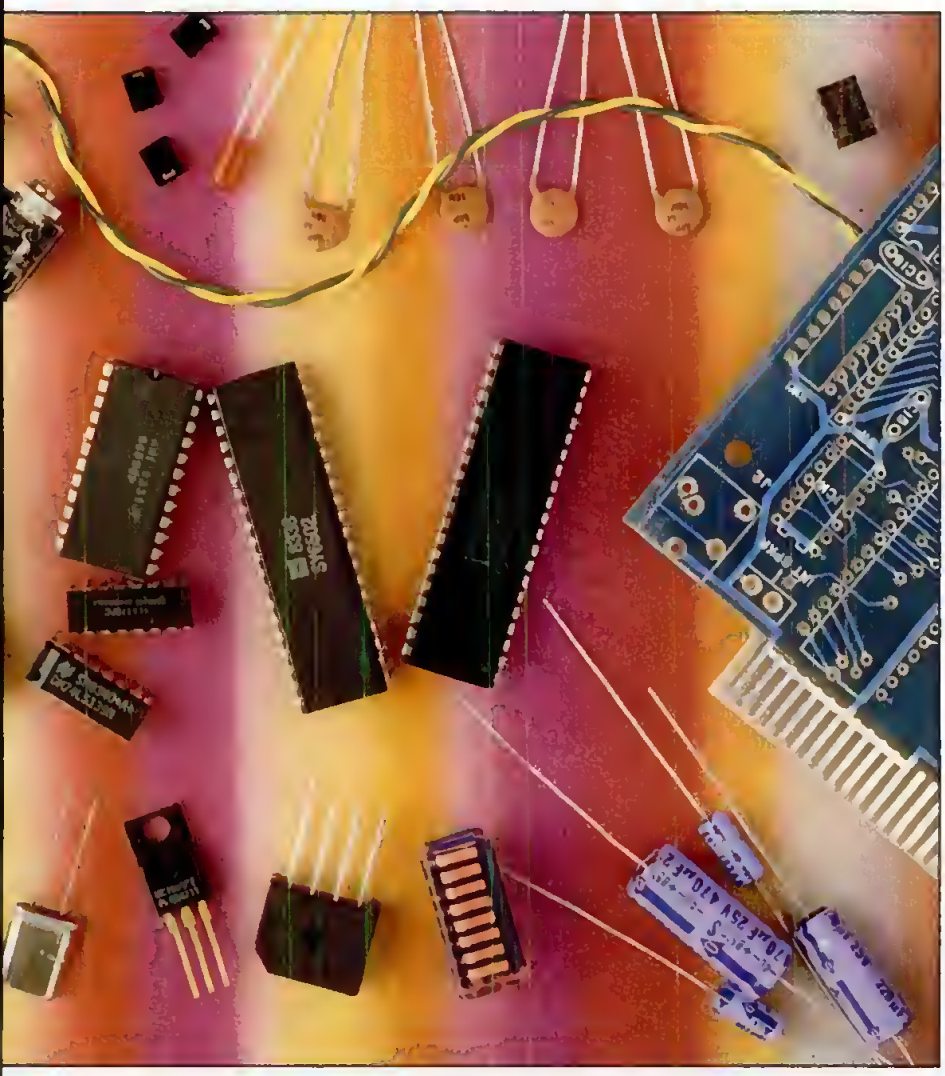
CIRCLE 686 ON READER SERVICE CARD

to cause concern about the quality and design of the product. Certainly, the quality of the construction depends on your abilities and patience. Beyond that, however, the worth of the finished product depends on the design of the MicroVox itself.

The finished MicroVox will sound familiar if you've ever encountered one of the most popular voice synthesizers, the Votrax.

The primary differences between the MicroVox and the Votrax are cosmetic. MicroVox's case is rectangular taupe plastic rather than the Votrax's more robust (and unusual) flattened prism-shaped aluminum housing. The transformer that gets permanently wired to the MicroVox is detachable from the Votrax. The Votrax has a built-in speaker; the MicroVox requires an add-on speaker (or complete audio system) of your choice.

Functionally, however, the MicroVox and Votrax are nearly identical—since both rely on the same voice synthesis chip, the Votrax SC-01A. Like the Votrax speech synthesizer, the MicroVox can create English-sounding verbiage from a stream of ASCII text characters. Its vocabulary is essentially unlimited. Although punctuation and inflection of the synthesized speech may be at variance with your own dialect or even modem American usage, it is, for the most part, understandable.



You start with the fundamental integrated circuit chips. Then, armed with the hardware, you can go on to design and develop your own voice synthesizer.

SPEAKING WITH AN ACCENT

You can work around MicroVox's idiosyncratic pronunciation either by sending it slightly altered spellings to elicit the proper phonemes (basic sounds) or by developing in yourself a tolerance for vocal variations such as computter instead of computer. Listen to the MicroVox long enough and you'll eventually understand your computer's utterances, even if no one else can.

Beside text-to-voice synthesis, the MicroVox can generate voice from a special phoneme code, act as a rudimentary music synthesizer (it generates tones), and read text letter by letter.

Objectively rating the quality of its voice is difficult. Though the output of the finished MicroVox is amazing, more complex systems produce much more intelligible voices. If you don't do elaborate programming to change MicroVox's pitch and inflections, it sounds like a mechanical male tenor with a strange, thick accent. Some phonemes seem to start too abruptly and sound clipped.

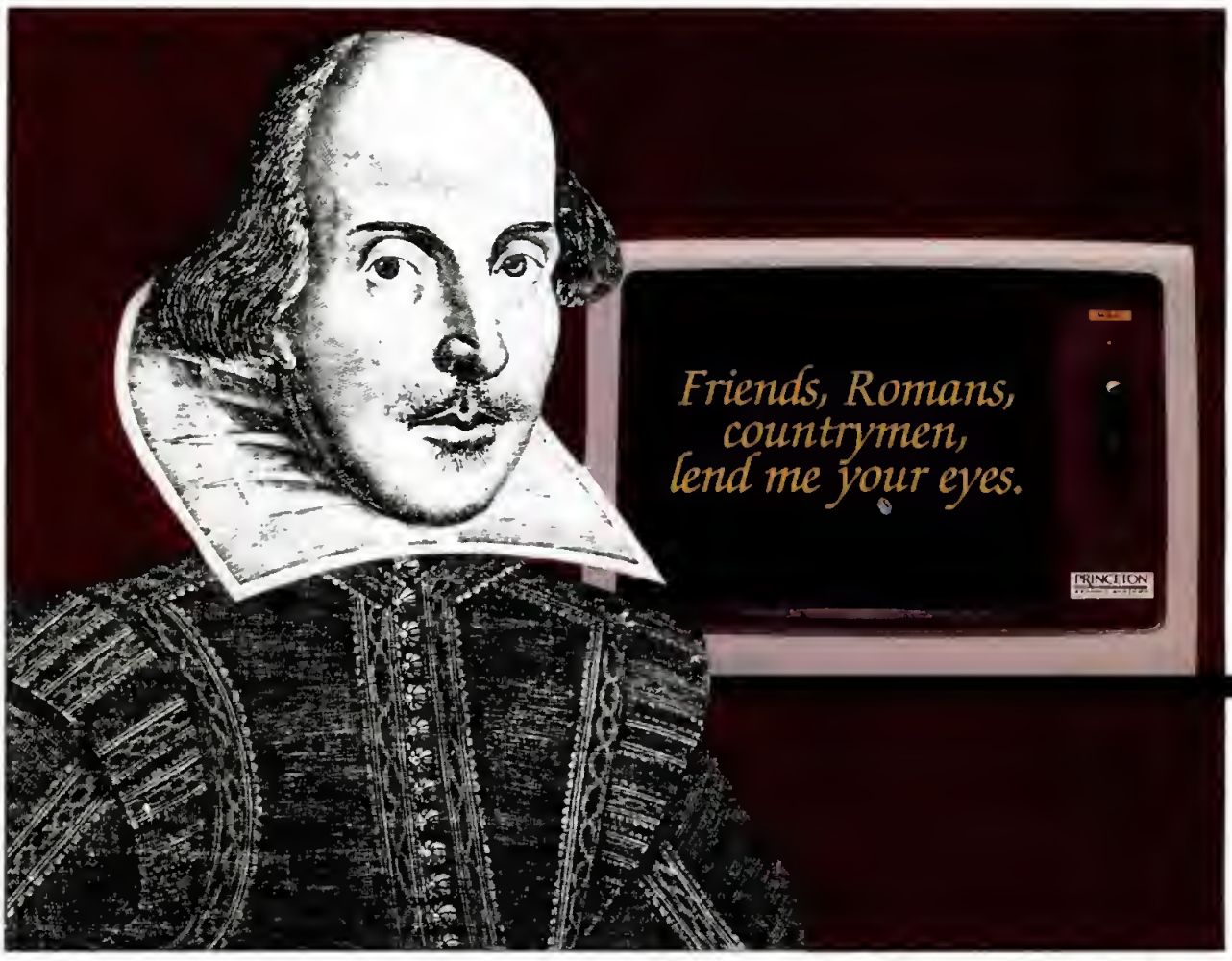
Connected to a small speaker or telephone (through an FCC-approved connecting network, please), MicroVox's voice quality is good enough to be understood against the background of MicroVox's electronic hum. Plugged into a stereo system, however, MicroVox's technical quality is abysmal. Turn up the volume and the power-line hum will rattle your speakers off their stands. (This observation is meant mostly as a warning and not as an admonition—the MicroVox is not promoted as a hi-fi device.) *(continued)*

Great Ideas look even better on a Princeton monitor

Your Great Ideas deserve the best image you can give them. But, just as a music system's performance depends on the speakers, your computer system is limited by the quality of your monitor.

Monitor performance can be measured. That's something you should know about.

In other words, your Great Ideas should be seen, not blurred.



W. Shakespeare composing Great Ideas on a Princeton Monitor

Things you should know about monitors

Resolution The quality of a color monitor's image is directly related to its resolution. The greater the number of dots available within a given area for displaying an image the greater the resolution.

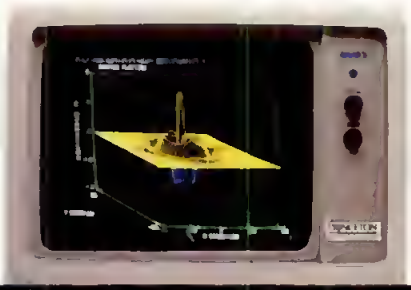
The PRINCETON SR-12 monitor features an extraordinary 640x480 (non-interlaced) resolution. The result is an extremely high quality, flickerless image with text that approaches monochrome quality. When used in conjunction with the PRINCETON Scan-Doubler card, the SR-12 runs from a standard IBM or equivalent color card, maintaining complete compatibility with all IBM software.

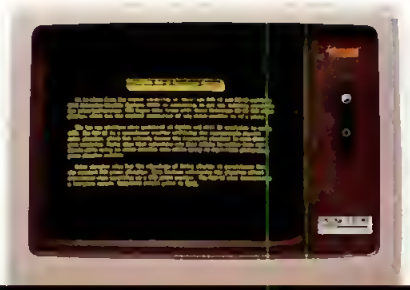
Dot pitch The image on an RGB color monitor is made up of a series of tiny dots. Dot pitch measures the distance between those dots. Anything finer than .38mm is considered high resolution.

The PRINCETON HX-12 RGB color monitor, with a dot pitch of .31mm, offers the finest resolution in its class. The HX-12 delivers 16 crisp, sharp colors including clean whites without color bleed—a not-so-easy accomplishment in an RGB monitor.

Price All Princeton monitors set the price/performance standard in their class. The SR-12 at $799 compares favorably with monitors costing hundreds more. The HX-12 is in a class by itself at $695.

The PRINCETON MAX-12, with easy-on-the-eyes amber phosphor, sets the standard for monochrome monitors at $249. The MAX-12's dynamic focusing circuitry ensures sharpness not only in the center but also in the edges and corners. And it runs off the IBM PC mono-card—no special card is required.





All three monitors feature a non-glare screen and an IBM compatible cable. A PCjr adapter cable is also available for the HX-12. And to see your Great Ideas from the best possible angle, you can put your Princeton monitor on the Princeton Undergraduate Tilt and Swivel Base for only $39.95.

Image The ultimate test of any monitor is how the image looks to your own eyes. Compare the Princeton monitors side-by-side with the competition at Computerland, Entre or your local independent dealer.

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CIRCLE 161 ON READER SERVICE CARD

ALMOST HUMAN

Despite its modest price and easy assembly, MicroVox is a powerful and complex device, no less so than a complete computer in its own right. It uses a 6502 microprocessor for self-control—the same microbrain that runs the Apple II series of personal computers. The programming for the tiny computer is stored in two ROM chips.

The true miracle inside the MicroVox, however, is the Votrax chip. The SC-01A simulates the human voice by using a mathematical model of the vocal tract and generating signals with a spectral content that corresponds to the way the human analog would vary. Using dynamic filtering, it essentially simulates the changes brought by varying aspiration and by movements of the tongue and lips. The filtering changes are controlled by an input code that encrypts all the phonemes used in human speech. The 6502 uses a powerful algorithm to translate strings of ASCII text characters into the proper phoneme code.

Voice pitch is controlled by an internal oscillator and can be varied for inflection or to change voice range. The speed at which the SC-01A changes its parameters can be varied to alter speech rate.

All the SC-01A's vocal variations can be manipulated either by commands from your PC or automatically by the 6502 microprocessor.

THE RULING ROM

The automatic control is probably the most sophisticated part of the MicroVox. When the MicroVox receives ASCII-coded text, it breaks down every word into phoneme equivalents. Any first-grader confronting a spelling test knows how complex and confusing that conversion can be. For instance, many times the pronunciation of a word may be governed not by spelling but by the context in which it is used.

The MicroVox isn't even as smart as a first-grader. It cannot analyze the sense of a sentence to determine the correct pronunciation. Instead, it must rely on an abbreviated set of rules on an 8K ROM chip that dictates how to dissect words into their phoneme equivalents.

When the MicroVox receives ASCII-coded text, it breaks down every word into phoneme equivalents.

The MicroVox does, however, examine a sentence for certain inflectional information. For instance, it raises the pitch of a final syllable when a question mark follows. The inflection is so natural you might not appreciate it—until you turn the feature off.

START-UP COSTS

Without the right tools you won't be able to put this kit together. And if you don't have the right tools, or can't borrow them from a more mechanically inclined friend, you'll wipe out your savings buying them.

To start with, you'll need a soldering pencil (27 or 33 watts is a reasonable rating) and several feet of good-quality, rosin-core, small-diameter electronics solder. Don't go looking for that soldering gun you once used to repair fish tanks—you'd be likely to melt your way through the circuit board.

Long-nosed pliers, diagonal cutters, and a Phillips screwdriver are other required tools. The pliers are for getting things in shape, and the diagonal cutters are for trimming off leads after soldering. (Don't use pliers that have their own built-in cutters; they don't do a neat enough job.) The Phillips screwdriver is needed for the final mechanical assembly. For the most part, smaller tools are easier to work with.

The MicroVox instructions wisely advise you to get a multimeter so that you can measure voltages inside the MicroVox after you've soldered in all the components and sockets but *before* you plug in the integrated circuits. Such a simple precaution could prevent blowing $80 worth of semiconductors.

Nearly any low-priced (or high-priced, if you're extravagant) multimeter will work. You'll only be measuring low DC voltages.

Think of these tools as investments. When you're bursting with pride after your homemade MicroVox says, "Mommy," you'll be glad you have them when considering other kits to assemble.

PUTTING THE PIECES TOGETHER

The instructions for the MicroVox are an intermediate step between the check-the-box-as-you-finish approach and the step-one-assemble-everything school. In the MicroVox instructions, parts are divided into broad classes. These classes must be completed in a specific order: first the resistors are assembled, then integrated circuit sockets (all ICs are socketed), then the capacitors, and finally the miscellaneous parts such as the volume control. Within each class, however, the parts can be inserted and soldered in any sequence.

The parts are spread across the printed circuit board with no assurance that R2 will be nearer R1 than is R18. Fortunately, however, the board is small enough (6.75 × 5.5 inches) and the parts to be installed few enough that you'll spend only a few seconds, barring unforeseen disasters,

hunting for the proper holes.

The instructions reflected the reality of the assembly quite well. Absent were any last-minute changes—revised part values or added components—that altered the original circuit design referred to in the instructions.

The sole exception to the timeliness of the instructions was the volume control, which the instructions say should be attached to the circuit board by short lengths of wire. This makes no sense since no wire is provided and the control mounts directly (and properly) to the circuit board with no problem.

In the course of assembly, I was frustrated only by one layout feature—a dot on the circuit board that indicates the polarity of the single resistor network MicroVox uses appears on the wrong side (but the right end) of the network's mounting position.

The only other area for improvement—of which even the instructions take note—is the silk-screening of legends on the circuit board. The legends indicate the location of each part. The kit would be a hopeless jumble to the neophyte without them. However, the identification for each integrated circuit is squarely in the center of that chip's ultimate location. And, unfortunately, step 2 of the assembly instructions has you cover this area with a big black IC socket, thus making the legends invisible. Although the instructions provide a Band-Aid solution—the map and a warning—it would be more reassuring to have the part number or circuit identification screened on the board so as to be visible around the socket.

Shortcomings having been noted, assembly could not be easier. At 5:30 one evening, I cleared my desk to make room for the kit and ameliorate a potential fire hazard, plugged in my soldering iron, and by 7:30 should have finished. Alas, the job was so trouble-free that I became overconfident, and some of my work required a bit of, uh, correcting. Assuming some soldering experience and reasonable ego strength, you should hear your MicroVox utter its first word, "Ready," in about 2 hours.

No matter what computer you have, you'll likely be able to make the MicroVox listen to it.

PROPER CONNECTIONS

When the MicroVox was first designed, IBM personal computers were not yet the undeniable industry standard. Moreover, the MicroVox was designed to be a universal device that could be connected to almost any small computer—or even an ordinary data terminal. No matter what kind of computer you have, you'll likely be able to make the MicroVox listen to it.

Just plug it in and pretend that the MicroVox is a printer that uses sound waves instead of print for its output. As with a printer, you only need to send data to the MicroVox. It has dual interfaces so it can act like either a parallel or serial printer—your choice—selected by a jumper on the circuit board.

The easiest connection to use is the parallel interface. MicroVox doesn't quite cooperate with the norm for parallel ports. Rather than the 36-pin connector most manufacturers use or the 25-pin D-connector IBM thinks is best for parallel interfacing, the MicroVox uses a plain circuit board edge connector. This means that part of the main circuit board is extended and has gold-plated contact fingers, which slide into a mating connector. You can either buy an adapting cable from Micromint or use the tools you have left over from the construction project to make one. You'll only need to find the appropriate wire and connectors.

The serial port of the MicroVox will use nearly any data rate that your PC can handle (50, 300, 600, 1,200, 2,400, 4,800, or 9,600 bits per second) as well as your choice of data bits and parity. Other jumpers allow you to select either hardware or XON/XOFF handshaking and even whether the MicroVox acts like a DTE (data terminal equipment) or DCE (data communications equipment) device (which amounts to whether you should use a "null modem" or ordinary interconnecting cable).

If you choose to connect the serial port to COM1 on your PC, configuring the MicroVox to 2400 baud, 8 bits, no parity, and to act as DTE, you won't have to use the DOS MODE command to change any of your PC's communications settings, and you can use an ordinary, store-bought, straight-through cable.

SOUNDING OFF

In order to hear anything the MicroVox says, you'll also have to connect an external speaker. (I don't know why one is not built in—it has its own internal amplifier.) For the external speaker connection, you'll need a mini-phone plug that mates to the kind of input your speaker uses. The quarter-watt or so that the MicroVox can generate should probably be sufficient for most small, non-hi-fi speakers (or *efficient* high-fidelity speakers). Otherwise, you might want to connect the external speaker output to your stereo system and turn your bass control down to eliminate the hum.

Once your MicroVox starts sounding off, your voice synthesis project will only be beginning. ■

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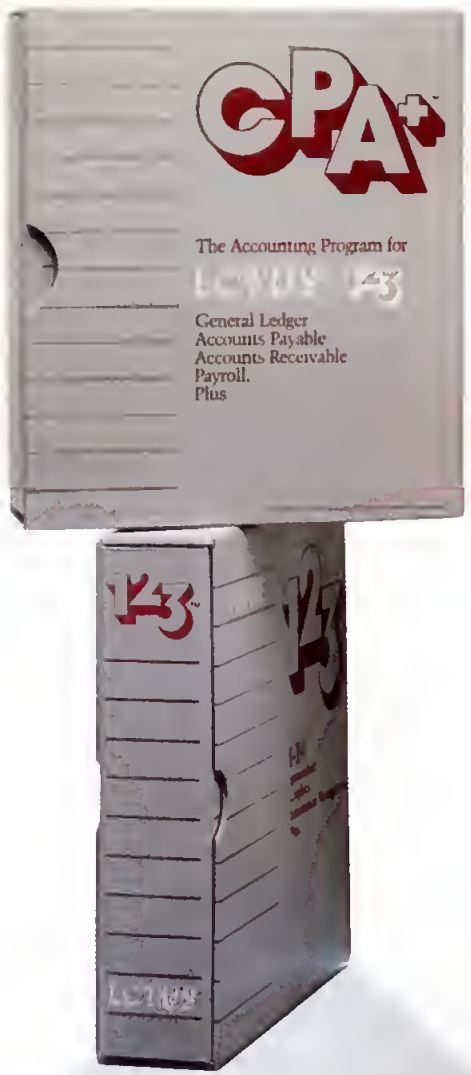

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CIRCLE 268 ON READER SERVICE CARD

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Press the Ins key The Create menu appears.

Press the (up) arrow key You've selected Outline.

Press the Return key A skeleton outline appears.

Type the word Outline "Outline" (the name you've given the outline) appears on the frame border.

Press the Return key You've finished entering the name of the frame.

Press the grey + key The blinking cursor moves from the border into the frame to heading 1.

Type the heading you want for 1. The words appear in the outline and at the bottom of the screen.

Press the Return key Heading 1. is complete.

Press the (down) arrow key The cursor moves to 1.1.

Type what you want and press the Return key Heading 1.1 is filled in.

Press the (down) arrow key The cursor moves to 1.2.

To add a heading anywhere, **press the Ctrl key and C key together, then press the E key.**

To add a subheading, **press the Ctrl and grey + keys together.**

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CIRCLE 210 ON READER SERVICE CARD

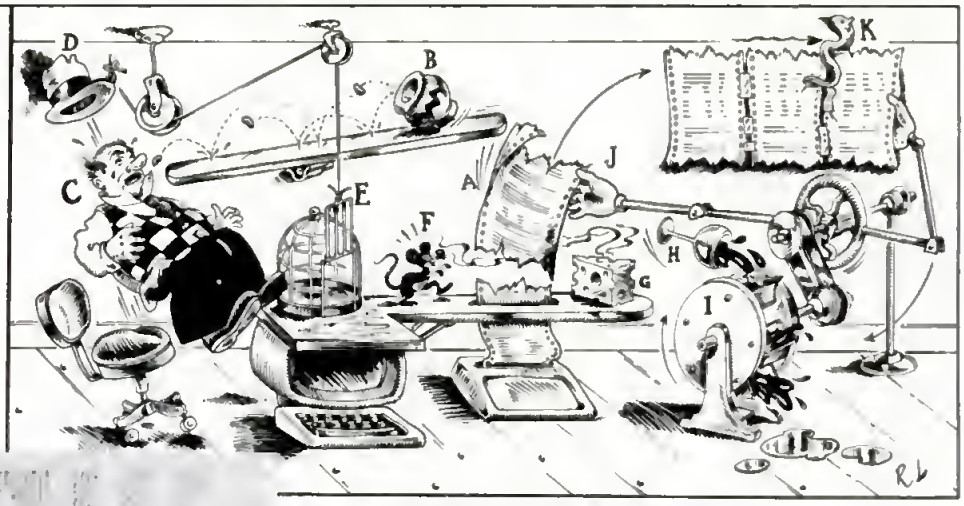
SIMPLIFIED SPREADSHEET ASSEMBLY

RISING SPREADSHEET (A) KNOCKS MEXICAN JUMPING BEANS (B) INTO MOUTH OF NEUROTIC MAN (C) WHO IS SO DISCOMBOBULATED THAT HIS HAIR STANDS ON END, DISLODGING HAT (D) WHICH OPENS CAGE (E) AND RELEASES EPICUREAN MOUSE (F).

MOUSE, INSPIRED BY SCENT OF PERFECTLY AGED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET, ONLY TO DISCOVER HE HAS BEEN FOOLED BY AROMA OF OVER-RIPE GORGONZOLA (G)

IN A FIT OF PIQUE HE SPILLS VINTAGE WINE (H) INTO WATER-WHEEL (I) WHICH TURNS PULLEY THAT CAUSES GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

SHEET IS TAPED SECURELY IN PLACE BY TRAINED ADHESIVE TAPE WORM (K).



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CIRCLE 305 ON READER SERVICE CARD

Fiber-optic networks are making a subtle entrance into the world of personal computers.

FIBER OPTICS LIGHT UP NETWORKS

Fiber-optic communication is the transmission of signals as pulses of light through hair-thin pieces of glass, as opposed to the standard method of sending electrons through wires. The use of this technology in telecommunications is becoming increasingly evident, but it is making a much more subtle entrance into the world of personal computers. Fiber-optic connections link high-speed data to and from mainframes, graphics terminals, and clusters of personal computers and are beginning to be used in local area networks.

It's only natural that one of the first fiber-optic local area networks to include personal computers is operating at one of the world's leading makers of optical fibers, the Corning Glass Works's Telecommunications Products Division in Corning, New York. The network links a couple of IBM PCs with a Digital Equipment VAX superminicomputer and about 30 DEC Rainbow personal computers. Corning built the network to show off fiber-optic technology, not as a commercial product, according to senior marketing analyst Scott Esty, who adds that "there's nothing special about it except the connections are fiber optic." But, special or not, the network is in daily use.

A more typical use of fiber optics with personal computers is at Sun Microsystems, a maker of high-performance computer workstations in Mountain View, California. The company uses a fiber-optic link from Pacific Bell to connect

local area networks in two separate buildings. IBM PCs and other devices are connected via wires to two intrabuilding systems that are based on the Ethernet standard. The optical link, which carries signals between the two wire networks at the 10-megabit-per-second Ethernet rate, makes the two separate networks look like a single local area network to the user.

IBM has been looking at optical fibers for years but is cautious about committing to their use. The IBM PC Network, which was announced last August, uses 75-ohm coaxial cable (the same type that's used in cable television systems) to transmit 2 megabits per second. However, the fiberless PC network will connect with the local area network that IBM is developing around the IBM Cabling Network, which does include fiber optics and will operate at higher speeds to interconnect a range of computers and terminals.

Other companies are not as cautious as IBM, but only a handful of products are specifically aimed at personal computer users. American Photonics Inc. of Brookfield Center, Connecticut, and Fibronics International Inc. of Hyannis, Massachusetts, both offer fiber-optic systems to link remote clusters of personal computers to other networks. Math Associates Inc. of Westbury, New York, American Photonics, and others offer RS-232 modems for use with fiber-optic cable. The Artel Communications Corp. of Worcester, Massachusetts, makes fiber-optic links to carry high-speed data to graphics terminals. Fiber-optic versions of Ethernet LAN hardware are offered by the Codenoll Technology Corp. of Yonkers, New York; FiberCom Inc. of Roanoke, Virginia; Siecor FiberLAN Inc. of Research Triangle Park, North Carolina; and Ungermann-Bass of Santa Clara, California. And new products appear daily.

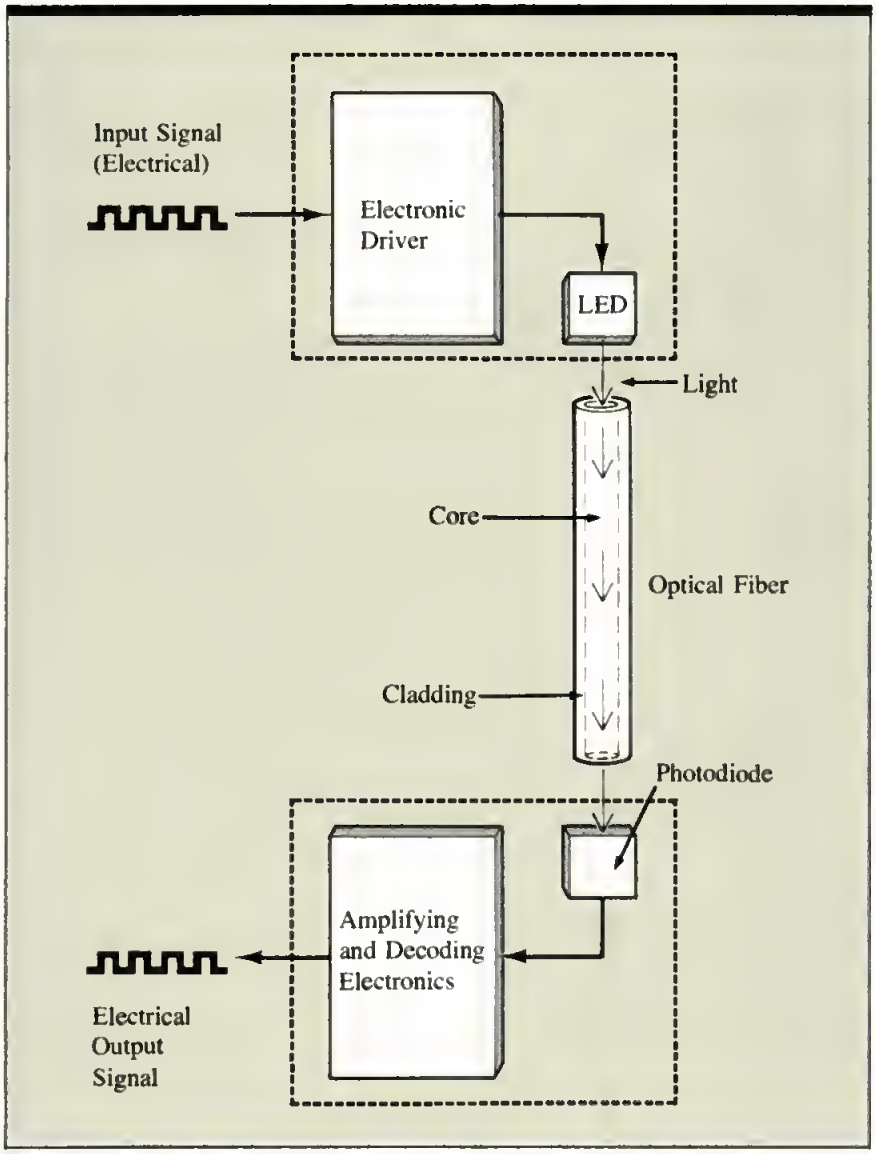

Figure 1: *Basic components of a simple fiber-optic link between two devices, including an LED on the transmitter end and a photodiode on the receiver end.*

A Fiber-Optic System

In a simple fiber-optic system (see Figure 1), input data arrives in standard electrical form at a transmitter, where it controls the electronics that drive the light source. For most computer applications, the light source is a light-emitting diode, or LED, but long-distance transmission may require a semiconductor diode laser. Signal pulses of light from the LED are collected by the optical fiber. The fiber is an optical waveguide, which confines light within a central core of ultratransparent glass that is surrounded by a cladding layer of glass that has lower optical density to keep the light from leaking out. It carries the light to the receiver, where a semiconductor photodiode converts the light pulses into electrical pulses. Electronic circuits in the receiver process the photodiode signal to produce clean digital electrical pulses.

A simple link, which is shown in Figure 1, connects only two devices, but a network must connect many. This presents a problem because, unlike electrical wires, optical fibers cannot be tapped easily. To deal with this problem, many developers of fiber-optic networks have turned to the star topology (see Figure 2). In such a net-

work, the signals from many fiber sources are mixed in a single device, which is known as a star coupler, and then are distributed to output fibers. Two or more stars can be linked together to make a larger network. However, star couplers are not absolutely necessary to make a network that connects multiple devices; Fiber-Com's fiber-optic version of Ethernet does not use them.

Fiber optics can transmit data within a local area network or between two points.

Fiber optics can transmit data within a local area network or between two points. One increasingly common use of fiber optics is a hybrid arrangement (see Figure 3) in which a fiber-optic cable is used to extend a local area network to a cluster of remote personal computers or terminals. Signals from the remote devices are multiplexed together—that is, combined in a manner that allows separating at the other end—for transmission over the fiber-optic cable to a network node. At Ethernet's 10-megabit-per-second data rate, optical fiber can transmit signals 2 or 3 miles to remote buildings—much farther than coaxial cable—and without need for expensive repeaters. Such network extensions account for many of the data-transmission applications of optical fibers.

The ability to transmit high-speed data over longer distances than are possible with coaxial cable or other copper-wire systems is an advantage of fiber optics. As the data rate increases, this advantage becomes more apparent because of the fundamental differences between fiber-optic and electrical transmission. Signal losses in wires increase steadily with signal frequency, but those of fiber optics are independent of signal frequency until a cutoff frequency is reached. That allows such incredible feats as when AT&T Bell Laboratories sent a 2-gigabit-per-second signal through 81 miles of repeaterless optical fiber last summer.

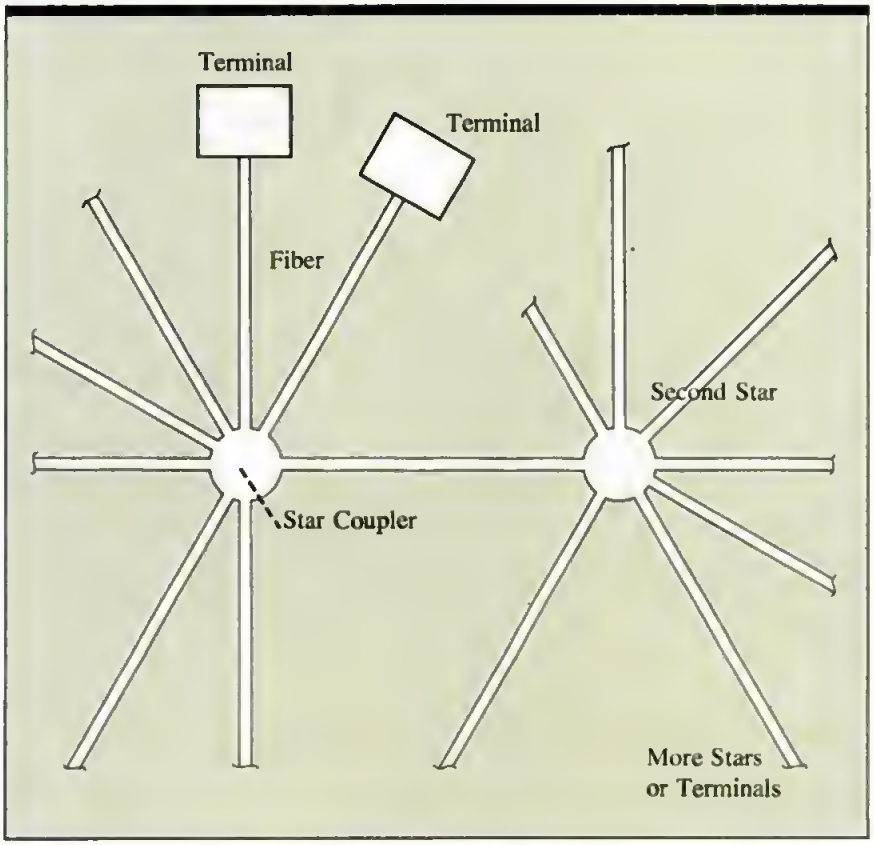

Figure 2: *The star topology is often used for fiber-optic networks because of the difficulty in coupling optical fibers. Multiple stars are used to form a larger network.*

Important Advantages

Fiber optics also have other advantages that can aid data transmission:

- They are immune to electromagnetic interference, which can scramble signals by introducing noise onto transmission lines. Thus, fiber optics can carry signals alongside power lines and through places where powerful radio signals could block transmission on wires.
- Fiber optics provide high security because it is extremely difficult to physically tap into them. If a fiber-optic connection *is* tapped, the resulting drop in signal intensity can be detected by users.
- Fiber-optic cables are small in diameter and lightweight, which simplifies installation, particularly in existing buildings.
- These cables do not carry electricity, so ground loops that can cause problems with electronics are eliminated and the fire hazards that sparks can pose in such places as oil refineries are avoided. In addition, cable installation does not need to comply with electrical codes.
- It's easier to fire- and smokeproof fiber-optic cables than electrical cables because optical cables do not carry current, and their smaller size requires smaller amounts of expensive special materials.

Unfortunately, the many advantages to using fiber optics don't tell the whole story. Costs are generally high because fiber-optic cable is more expensive than

wire cable, and it requires special transmitters and receivers. It is much harder to split optical signals between two or more fibers than to divide electrical signals among wires—a key problem in building networks to serve many terminal devices. It's the technological differences of fiber optics that scare off potential users.

Another factor that limits the widespread use of fiber optics is that most data communication—particularly to and from personal computers—occurs at slow speeds. Most personal computer users are delighted with 1200-baud communication, explains Rick Jones of Siecor, and they feel no need to move to the much higher speeds where the benefits of fiber optics become more important. However, that is beginning to change because increasing numbers of personal computers are hooked into local area networks that operate at 1 megabit per second or faster. Sophisticated graphic displays also require high data rates. And as fiber optics prove out in the telephone industry, data communications specialists are slowly being cured of their "fiberphobia."

Using Fiber Optics

Local area networking does not directly increase the data rate to or from an individual personal computer or terminal. Instead, it provides a data highway to handle signals to and from an array of devices. This data highway has to operate at a high speed to support many devices; for example, it has to run at 2 megabits per second in the relatively simple IBM PC Network and 10 megabits per second in Ethernet, which is designed to support a broader range of terminals. The range of these speeds is large enough to open the door for fiber optics.

Some fiber-optic products are intended to enhance performance of local area networks that are not based entirely on fiber. For instance, American Photonics has developed what the company chairman, James Walyus, calls a fiber-optic "extension cord" for Ethernet. One end plugs into a concentrator that interleaves data from up to eight personal computers or terminals into a single data stream; the other end plugs into the main network. The company says the fiber-optic link can operate over 500 meters—ten times farther than coaxial cable—and that it is transparent to the system hardware and software.

A similar concept is the base of the Cable Bandit, which is offered by Fibronics. Sales manager Kenneth Bowes says that a single two-fiber cable can carry 8 to 32 channels to and from a mainframe node. One model, the 1677XT, is designed specifically to tie IBM PC-XTs to a mainframe controller. Bowes says that Fibronics has sold over 1,000 Cable Bandits, with most applications involving

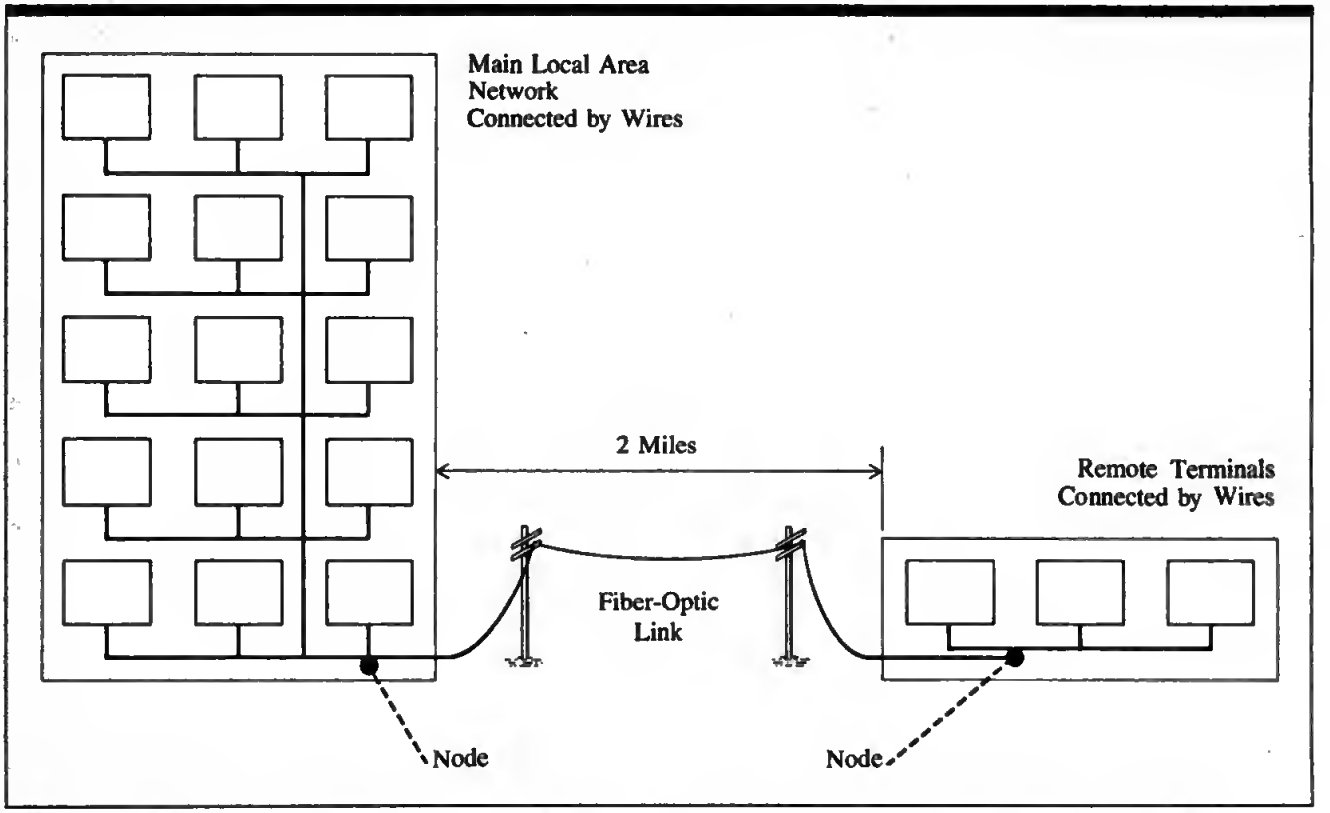

Figure 3: *A connection of a few remote terminals or personal computers to a local area network in another building is possible over fiber-optic cable—even if the buildings are separated by a couple of miles.*

databases and file transfer. A version in the works will carry 128 channels over a two-fiber cable.

Fiber-optic Ethernets are also available, but, demand has been much smaller for them than for fiber-optic extenders for coaxial cable networks. Siecor's Jones says that most such uses of fibers are as backbones or interbuilding links in networks interconnecting mainframes with dedicated terminals. Interbuilding connections are difficult to make by wires because each Ethernet segment can have only a single grounding point—a problem when the segment spans two or more buildings. Long transmission distances and the need for high-transmission rates to certain terminals, such as the graphics workstations used in computer-aided design, can also point to a need for fiber-optic connections. Because of their low data rates, individual personal computers generally have not been directly connected to optical fibers, but remote personal computer clusters may be linked to fibers.

About the only reason that justifies the direct connection of a personal computer to fiber optics at 1200 baud is severe electromagnetic interference (EMI), Jones says. Wire connections suffer from EMI because they can function as antennas, so strong electromagnetic fields can induce currents in them. EMI can come from many sources, including radio transmissions, lightning strikes, power lines, and electric motors, and can cause serious data-transmission problems. In fact, EMI led to the installation of one of the country's first fiber-optic data networks at the Froedtert Hospital in Milwaukee; the radio paging system for physicians had been knocking out data transmission between the hospital's mainframe and terminals.

There are plenty of other places where EMI can impair data transmission. For instance, interference is so severe in some environments that electronic equipment must be placed in "screen rooms," which have wire-mesh shields that block electromagnetic fields. Wires can't be used to communicate from a screen room, and some occupants have been literally forced to pull strings to convey messages to the outside world. Fiber-optic connections offer a way around the problem. They can also share elevator shafts and conduits with power lines and pass by heavy machinery without picking up excessive noise. Moreover, EMI is a severe problem

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inside automobiles and is one reason that automakers in Japan and the United States are working on fiber-optic systems that would transmit control signals at about 400 baud throughout cars.

Sun Microsystems chose fiber-optic cables to connect its two buildings because fiber optics secure data against unauthorized access and accidental errors. Financial institutions have also been interested in fiber optics for data communication, and so have military and security agencies. As far back as 5 years ago, the Army Harry Diamond Laboratories in Washington, D.C., installed a fiber-optic network linking a central IBM 370 mainframe and three Prime 400 minicomputers with remote terminals, and the security of classified data was a major concern.

The easy installation also helped to tip the scale toward fiber optics, according to Dennis Cook, who directed the installation of the Army system. Others have cited the same advantage. The small fiber optic cables can be easily strung through existing walls and above suspended ceilings without the need for conduit or other expensive special equipment needed for current-carrying wires. The simplicity of installing fiber-optic cables is a major reason that Pizza Hut is buying 2,500 fiber-optic links from the Norand Corp. of Cedar Rapids, Iowa. The restaurant chain will use the fiber-optic cables to carry data from cash registers back to a small computer in the manager's office.

Fire codes also push the use of fiber optics, according to Walyus of American Photonics. Many communication cables have been strung through air ducts because they offer ready connections between various parts of buildings. Fire officials have been worried that this practice could cause smoke from cables that are burning in one part of a building to spread throughout the entire ventilation system. To avoid that problem, fire codes now require that cable strung through air ducts be of a special "plenum" construction, employing materials that do not produce smoke. The smokeless materials are expensive, and coaxial cables made with them are more expensive than standard types. The increase in cost of fiber-optic cables is smaller because they require much less smokeless material. The result, Walyus says, is that fiber-optic plenum cable actually costs less than coaxial plenum cable.

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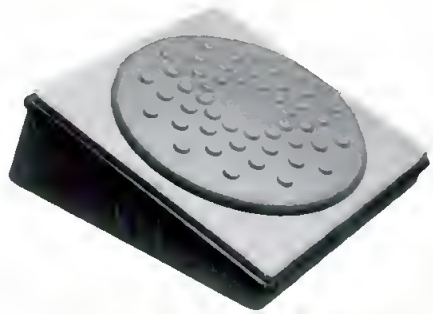
The high cost of installation labor provides another impetus for fiber optic cables, because they are less likely to need upgrading. Most fiber data-communications customers want to put in cable that can support communications for many years to come. "They are looking to future upgrades with the same cable," says Bowes of Fibronics. For example, the telephone companies that are installing fiber-optic cables for long-distance communications are following the same philosophy and are installing cables with more fibers than will be needed at first.

Meanwhile, system developers are working on fiber-optic local area networks even faster than Ethernet. Canstar Communications of Scarborough, Ontario, is testing its 50-megabit-per-second Hubnet system at the University of Toronto and at an unidentified Canadian government office. The high speed is needed for file transfer between a hard disk that is attached to the central VAX or supermicrocomputer and remote terminals. Data transfer is fast enough so that users can quickly retrieve files as if their terminals had individual hard disks. Even faster fiber-optic local area networks have been tested in the laboratory; data rates of 200 megabits per second have been transmitted in one test at RCA Laboratories in Princeton. Although such high data rates seem well beyond the needs of most personal computer users, they can serve as terminals in such networks, along with faster devices and specialized workstations.

Fiber-optic connections to every personal computer are not just around the corner. Wires are adequate to send 300 or 1200 baud a few yards across a quiet office. But the proliferation of personal computers, both in number and in the type of applications they run, will make fiber-optic connections increasingly popular. Problems with EMI and cable installation and the growth of the size of local area networks will push the use of fibers, as will the increasing use of full-color and high-resolution graphics, requiring data rates well beyond 1200 baud.

In the short term, the makers of fiber-optic systems take heart in the fact that people no longer ask what fiber optics are. In the long term, they expect fiber optics to become pervasive in communications. "We know that someday everybody will use fiber optics," says Rick Jones of Siecor. But not yet. ■



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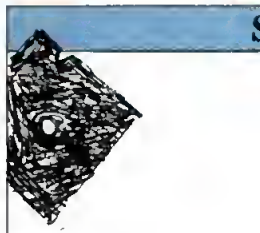

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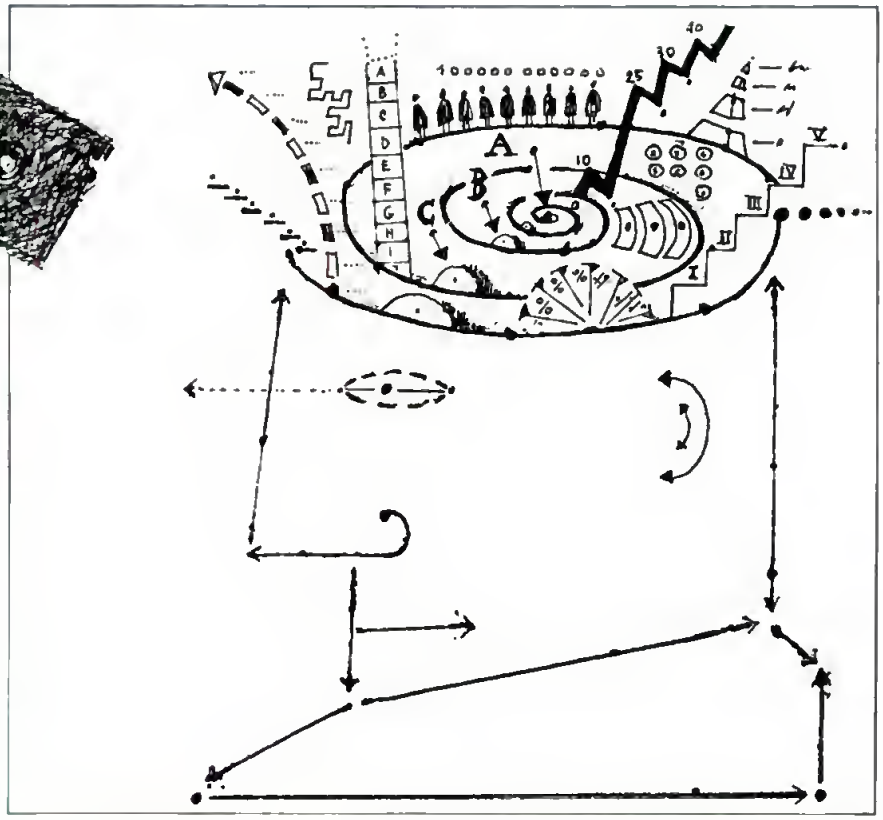

SYSTAT&EPISTAT

These two statistical packages can help you make sense of your data, whether you're an experienced statistical analyst or a beginning researcher.

PC users work with all kinds of data, from sales reports by region to the results of maze-learning tests with rats. In a wide variety of fields, statistical analysis by computer has become a useful and even critical tool. Census takers use it to track economic and social change; in manufacturing, it facilitates quality control. It can help others analyze the structure and dynamics of epidemics and of public health in general, study crop yields produced by different agricultural methods, perform actuarial analysis to determine insurance rates, conduct public opinion polls and market surveys—the list is endless.

PC users, therefore, need a statistics software package to clarify their data and help draw sound conclusions from it. But given the many diverse uses for statistics and the varied needs of different users, a single statistics package can not be ideal for all. Different packages have different orientations that usually reflect the author's field of specialization. However, there are two statistical packages for the PC that, between them, should satisfy the needs of most users.

The first of these, *SYSTAT*, is the creation of Leland Wilkinson, a social scien-

Illustration: Maciek Albrecht

tist and professor of psychology at the University of Illinois. *SYSTAT* is especially designed to handle large databases with many variables; it incorporates many advanced multivariate techniques used in the behavioral sciences.

The other package, *EPISTAT*, was developed by Tracy L. Gustafson, M.D., of Round Rock, Texas. While a more modest offering, *EPISTAT* is in its own way a surprisingly comprehensive package. It's especially suitable for performing common statistical procedures on medium-size data sets and the results of laboratory experiments.

The highly professional and individual nature of both these packages challenges the claim that the days of important contributions from cottage-industry programmers are behind us. Although they were designed to meet quite different needs, both packages are bargains. *SYSTAT* sells for $495, whereas *EPISTAT* is user-supported software that you can obtain by sending a contribution ($25 is suggested) to its author.

Gambling Started It

Always a practical science, modern statistics originated about 300 years ago when some French mathematicians became interested in the mathematics of gambling. As it grew to encompass broader fields, statistics was broken down into two categories: descriptive and inferential. Like most statistics packages, *SYSTAT* and *EPISTAT* make use of procedures from both categories.

Descriptive statistics helps you summarize large amounts of data so that you can digest them intellectually and make them the basis for action. One superb amateur descriptive statistician was Florence Nightingale, who collected and analyzed data on the causes of mortality in the British army during the Crimean War. Nightingale submitted an extensive report to the government on the conditions suffered by sick and wounded British soldiers, and this led to the eventual reform of the British army's hospital and sanitation system.

The other branch of the science—inferential statistics—depends on formal mathematics and allows you, within certain limits of probability, to draw general conclusions about large populations from relatively small, properly drawn samples. Ever since the Great Depression, the U.S. Department of Commerce has used inferential statistics, for example, to generate dependable monthly unemployment figures for the nation based on carefully conducted sample surveys.

> Modeled after SAS, a major mainframe package, SYSTAT is an ambitious product designed to deliver mainframe performance on a microcomputer.

Like most statistics packages, *SYSTAT* and *EPISTAT* perform both descriptive and inferential procedures. They allow you to summarize large amounts of data and draw general conclusions from small samples. Here's how they work.

Cordial System for Advanced Users

Modeled after *SAS*, a major mainframe package, *SYSTAT* is a highly ambitious product that has been designed to deliver mainframe performance on a micro. Time-sharing and even batch users of mainframe statistics packages will appreciate the benefits of this addition to PC software. Delays caused by changeovers in mainframes or systems and by downtime in mainframe CPUs and auxiliary devices can often make the actual turnaround time much higher on mainframes than on micros.

The manual accurately describes *SYSTAT* as being "cordial" rather than "friendly" to users. There are no menus to slow you down, and the system never wastes time saying please. Instead, its command structure is clear, terse, mnemonic, consistent across application modules, and comfortable to use. While menus might be easier for beginners, practiced users generally prefer a fast, interactive, and well-designed command language such as that of *SYSTAT*. On-line help is available at any time, and errors are considerately handled; syntax errors, for example, are immediately noted, and you may correct them without restarting. At the end of a session in any module, *SYSTAT* prints a log of all the commands that you typed, including transformations, deletions, formulas applied, and comments. This is especially useful if you made changes or additions to the data during the session.

SYSTAT, although copy protected, can be run from a hard disk and will automatically support an 8087 math coprocessor. We recommend both devices for optimal performance of the system; neither, however, is necessary. *SYSTAT* is able to handle any number of cases with up to 200

FACT FILE

SYSTAT, Version 2.0
SYSTAT Inc.
603 Main St.
Evanston, IL 60202
(312) 864-5670
List Price: $495 plus $5 postage and handling.
Requires: 256K RAM, one hard disk or two floppies.

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EPISTAT
Tracy L. Gustafson, M.D.
1705 Gattis School Rd.
Round Rock, TX 78994
List Price: $25 contribution suggested.
Requires: 64K RAM, one disk drive.

CIRCLE 686 ON READER SERVICE CARD

variables per case depending on available storage. Results, which are displayed on the screen, may also be sent to the printer or saved on disk.

The package consists of five disks plus a well-written manual that's oriented toward the knowledgeable statistics user. The manual makes no attempt to teach the subject. Wilkinson has chosen to leave that task to teachers and textbooks.

The manual concentrates on the software. It shows you how to run each procedure in *SYSTAT* and gives clear and substantively interesting examples throughout, such as crime rates by state and ratings of vintages of wine. Several of these sample data sets are given on the Data disk for hands-on practice analysis. This teaching approach is ideal for the user who is conceptually familiar with a given statistical procedure but does not know how to perform it with *SYSTAT*.

Impressive Capabilities

The statistical capabilities of *SYSTAT* are most impressive. In addition to the conventional cross-tabs, for example, you can produce multiway tables and perform log linear analysis on them using the Tables module. A single command is all you need to produce a useful variety of basic descriptive statistical analysis for all the cases in a file or for any combination of subgroups. A variety of paired variable functions are easily available: Pearson and Spearman correlations, variance-covariance matrixes, Euclidean distances, coefficients of monotonicity, and others. Nonparametric statistics are also covered thoroughly. Missing data is handled correctly and automatically throughout, and you are allowed to choose alternative methods when they're available (such as pairwise instead of listwise deletion in multivariate procedures).

Along with many other features, a number of multiple regression options are offered in the Multivariate General Linear Hypothesis (MGLH) module: linear, polynomial, stepwise, forced stepwise (hierarchical), and weighted regression are readi-

Seeing the Forest Through the Trees

Multidimensional scaling is a technique that helps you understand what your data is trying to tell you.

One of the more interesting advanced capabilities of *SYSTAT* is multidimensional scaling (MDS), a technique originally developed at Bell Labs. You can use it to discover the hidden structure in databases by inputting data concerning the proximity of objects in any category, such as cities, people, products, works of art, countries, or public figures.

The proximity measure can be any numeric indicator of how close or how similar two objects are. It does not have to be an objective measure, such as the airline distance between cities but can be instead a subjective one, such as a perceived similarity rating. The percentage of attributes that two objects have in common, distance values derived from attitude scale profiles, and correlation matrixes will also be accepted as input and analyzed.

The end result of an MDS analysis is a map showing a configuration of points that represent the various objects. Such a

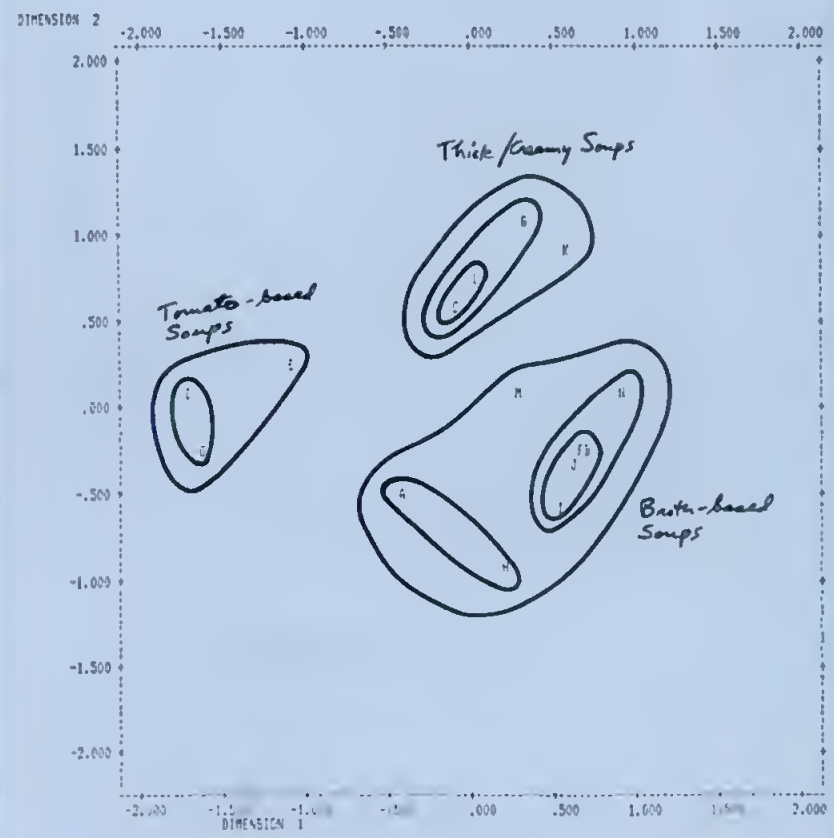

Figure 1: *An MDS map of how one respondent perceives the similarities among 15 different kinds of canned soup.*

(sidebar continues)

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ly accomplished. The MGLH module can handle up to 27 predictor variables. (For users with 512K or more RAM, a special version is available—for a slightly higher price—that can accommodate up to 128 predictors.) Regression diagnostics include residuals (which you may save to disk as new variables and analyze any way you wish), leverage, and collinearity measures. You can use this module for t-tests, *N*-way balanced or unbalanced, crossed or nested ANOVA, ANACOVA, and MANACOVA designs, as well as for univariate and multivariate repeated measures (mixed model) designs and canonical analysis. It can also perform discriminant function analysis, although the manual doesn't cover it.

The factor-analysis module (Factor) offers principal components with three orthogonal rotation alternatives (including VARIMAX), as well as the generation of factor scores that you may save to disk for further analysis. Factor matrixes can be row-sorted to highlight the structure—a nice touch. A simple command produces clear, well-scaled, and labeled bivariate plots of the factor space.

A separate module (Graph) produces not only the usual histograms and scatter plots but also the very informative stem-and-leaf diagrams and box-and-whisker plots of exploratory data analysis à la Tukey. More analytic graphic capabilities include normal probability, contour, and detrended residual plots. Although *SYSTAT* uses only character graphics, you can get higher-resolution hard copy graphs by using an Epson-type printer, the page-wide command, and the compressed (17 cpi) printing mode.

Two additional modules offer even further advanced capabilities: the MDS module does multidimensional scaling, and the cluster module does cluster analysis. (See the sidebar.) Each of these offers a variety of options and has the well-chosen default settings that are characteristic of *SYSTAT*. (A very comprehensive time-series analysis module that is about to be added to the package was not available for testing in

map is an easy way to see the overall structural picture hidden in the data. Figure 1 shows how MDS can visually represent one respondent's perception of the world of canned soups. This map is derived from similarity ratings on a 7-point scale that the respondent made on all possible pairs of 15 soups (listed in Figure 2).

SYSTAT first conducts a stress analysis and prints out a Shepard diagram to help you decide whether the data can be represented in two dimensions without excessive distortion. In this case, we obtained a stress value of .04, which means that the distances on the map closely correspond to the 105 actual similarity ratings in the database.

Although MDS plots the points, it does not group them into clusters. The data analyst often does such clustering, relying upon his own experience and judgment. We chose to submit the data to the default hierarchical clustering procedure in *SYSTAT*'s Cluster module, which produced the tree diagram that is shown in Figure 2 below. The clustering derived from the tree diagram was subsequently

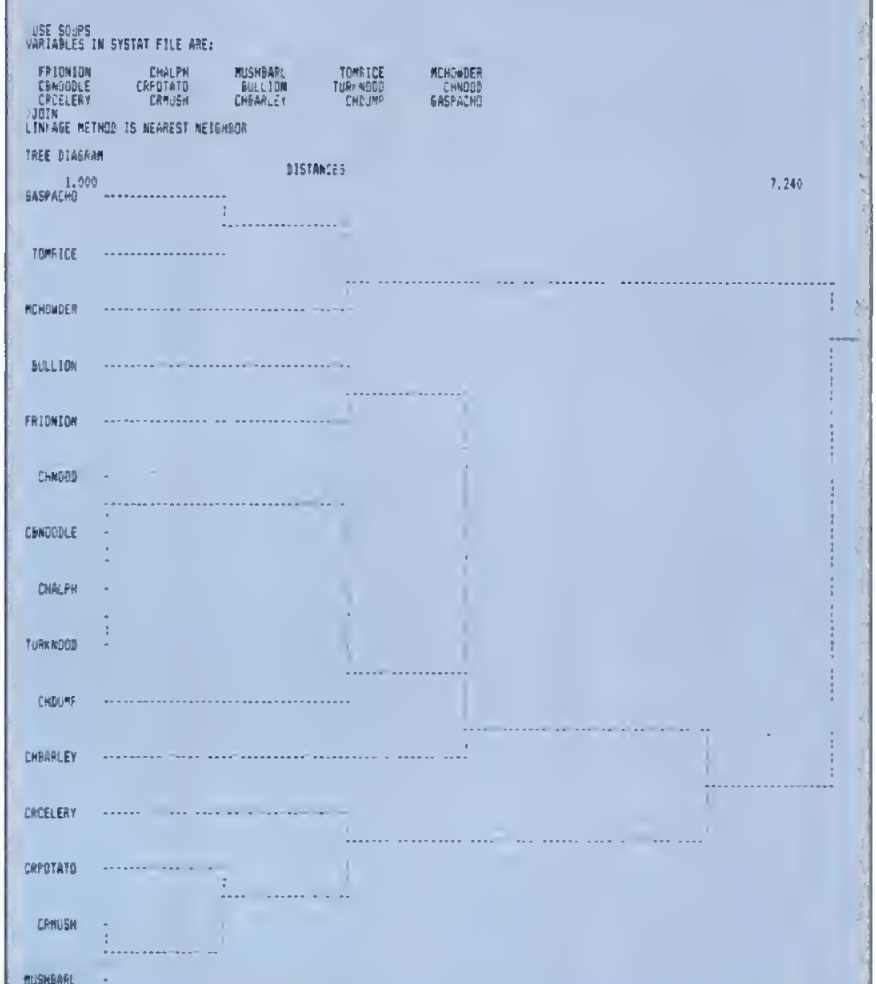

Figure 2: *A tree diagram, derived from the respondent's ratings, indicating the clustering of the soups.*

(sidebar continues)

marked by hand on the printout of the perceptual map.

Interpretation is quite straightforward and reveals three major groupings of soups. At the far left of the map is a cluster of tomato-based soups: tomato rice, gazpacho, and Manhattan clam chowder. To the right is a supercluster of broth-based soups. The major subgroup in this large cluster consists of five yellow broth soups: chicken noodle, turkey noodle, chicken alphabet, chicken broad noodle, and chicken dumpling. The minor subgroup consists of French onion and beef bouillon, both based on beef broth. Chicken barley completes the supercluster. The third major cluster is at the top of the map and consists of four rather thick, mostly cream-style soups: cream of mushroom, mushroom barley, cream of celery, and cream of potato. Data from a different respondent, of course, might produce a quite different pattern.

Researchers have applied multidimensional scaling to many subjects, although they usually work with summary data based on a sample of respondents rather than with a single individual's ratings. The technique has helped researchers analyze the perception of faces, study personality traits, discover which pairs of Morse code signals are most easily confused, observe the informal social structure of organizations, analyze beliefs and attitudes behind political ideologies, as well as study how consumers perceive and classify various brands in a product category.

Those who are familiar with MDS will be pleased to know that *SYSTAT*'s MDS module offers the option of either the Kruskal or the Guttman-Lingoes procedure and can produce results for up to five dimensions if necessary. A variety of hierarchical and nonhierarchical clustering options are also available with the package, including simultaneous clustering of both objects and variables.

—R.S.L. and J.C.

time for this review.)

Stress on Accuracy

Wilkinson has long been concerned with computational accuracy, which depends not only on the properties of the computer but also on the informed choice of computing algorithms, particularly in the case of multivariate methods. Some years ago he discovered gross errors in some very popular mainframe statistical packages and published a number of articles discussing their accuracy. Programmed in compiled FORTRAN, most *SYSTAT* calculations are done in double precision with 15-digit accuracy. Wilkinson claims that no widely used mainframe package exceeds *SYSTAT*'s accuracy in regression analysis.

The Data module includes almost all the data management capabilities of *SAS*. It can merge, join, and subset multiple files by one or more variables. It lets you sort, rank, and standardize variables by using one-word commands. An extended version of BASIC in the Data module makes virtually any kind of data transformation possible. You can enter data in either free or formatted form from either the keyboard or a file. Symmetrical matrixes are recognized and accepted in triangular form, with or without diagonals. If you choose to import files instead of entering data on the keyboard from within *SYSTAT*, you must first convert them into the binary code system files used by *SYSTAT* for computation. This means that you can employ your favorite editor with full-screen capability (such as IBM's *Personal Editor* or *WordStar* in nondocument mode) to key in the data. While such ASCII-to-binary conversion is somewhat time consuming (4.25 minutes for 1,500 cases with seven variables), you need to do it only once. After that, you can fly.

Unfortunately, no provision is made for verifying data entry, especially important when keying in large data sets or correlation matrixes. A full-screen editor along with a 100 percent verification routine to find and locate data-entry discrepancies and facilitate their correction would be very useful enhancements.

SYSTAT could be an indispensable tool for knowledgeable practitioners. It is highly advanced, exceptionally accurate, flexible, and fast. You can compute and factor a 25 × 25 correlation matrix in less than 45 seconds with an 8087 coprocessor, for example. Printout is not fancy. Labeling is limited but serviceable, printing takes place across the margins, and correlation

Wilkinson claims no widely used mainframe package exceeds SYSTAT's accuracy in performing regression analysis.

matrixes are produced in triangular form rather than in the more readable square format. The character graphics, while very useful analytically and quite respectable for academic settings, are not sufficiently polished for formal business presentations.

SYSTAT has some other minor weaknesses that should be corrected in future versions. A simpler method is needed for selecting a subgroup of cases for separate analysis. Currently, if you want to analyze only females, for example, you are forced either to perform the analysis on both sexes or to return to the Data module, write the BASIC statements that would create a new file of females, and then go back to the analysis module.

Other useful additions would be the capacity to list data files without returning to DOS, a command like TO in *SPSS* for quick reference to a series of listed variables, a backscrolling capability, high-resolution color graphics, and the capacity to create more attractive, fully labeled

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GOOD WITH STATS

reports. Oblique rotation in factor analysis would also be welcome.

All in all, *SYSTAT* is an impressive achievement and an outstanding value for the knowledgeable user who wants advanced statistical capability. For those who want more information on this package, an extensive and highly informative brochure is available from SYSTAT Inc.

Conscientious, Loving Effort

Most people who turn to personal computers for statistical analysis would probably find the power of *SYSTAT* overwhelming and largely irrelevant to their needs. A laboratory scientist who wants to perform a t-test can accomplish that simple task with *SYSTAT*, but would need to approach it as a special case of the multivariate general linear model—a little like killing flies with a shotgun.

When the statistical problem requires the analysis of only one or two variables at a time, you can hardly go wrong with Dr. Gustafson's carefully created package, *EPISTAT*.

This handy little gem does not only t-tests but also handles analysis of variance (one way and balanced two way), chi-square contingency tests, simple correlation and regression, two-sample rank tests, Fisher's exact test for 2 × 2 frequency tables, and some others that are of particular interest to epidemiologists and those in related fields (for example, the Mantel-Haenszel chi-square test, adjustment of rates, Bayes's theorem, and power analysis for rates). It also sets up quite respectable histograms, bivariate scatter diagrams, and cross-tabbed frequency tables, all labeled and readily printed out on a variety of printers. It provides table look-up for all the common statistical functions: normal curve, t, F, chi-square, binomial, and Poisson.

You can master data entry without too great an effort, though it is a bit tricky and awkward for some kinds of problems. You enter a rectangular data matrix whose rows are "cases" (units) and whose columns are either "samples" (groups) or variables, depending on the analysis. Provision is made for transferring data from FORTRAN files or between *EPISTAT* files for editing, combining, and subsetting files and for performing a modest set of data transformations.

Some other vital statistics: *EPISTAT* will hold up to 28 samples or variables and up to 2,000 data entries per file with no limit on the number of files. Its hardware requirements are modest: it will run with as little as 64K RAM, a single-sided disk drive, and a monochrome monitor. Naturally, things go better with more RAM, two double-sided drives, a color graphics board and monitor, and a printer. The program is written in BASICA, allowing modification by ambitious users (for example, to increase the maximum file size). All computations are single precision—more than adequate for these kinds of procedures—and therefore quite fast.

EPISTAT is friendly but not cloying. There are no modules. Everything is menu driven, with choices and instructions usually clearly presented. A fairly straightforward 10-page manual is printed from the disk and covers the various programs found in *EPISTAT*. Although properly disclaiming any attempt to teach statistics, an initial menu option "determines the best test for your data"; it gives some guidance to the statistically unsophisticated.

EPISTAT is nearly free of bugs. We found only one technical error of sequence. When asked to specify the direction of the difference between two population rates, the Samplsiz program, without warning, gives sample sizes that are correct for a *two*-tailed test.

As user-supported software, *EPISTAT* may be available for trial from your local computer club for a nominal ($5 to $7) charge. The author hopes that if you find it useful, you'll send a contribution—"any amount will be appreciated ($25 suggested)." With prices for statistical packages running much higher, if you are in the market, you should bypass the trial and simply send in the $25. You can hardly go wrong. ■

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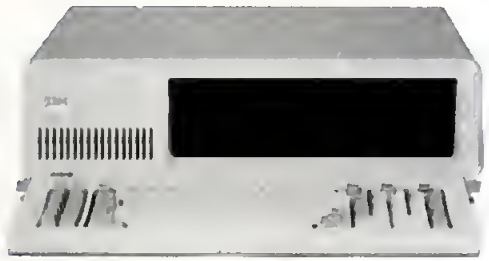

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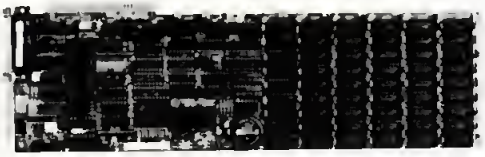

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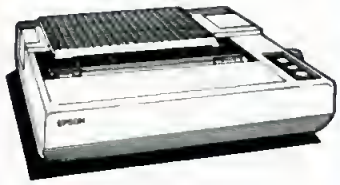

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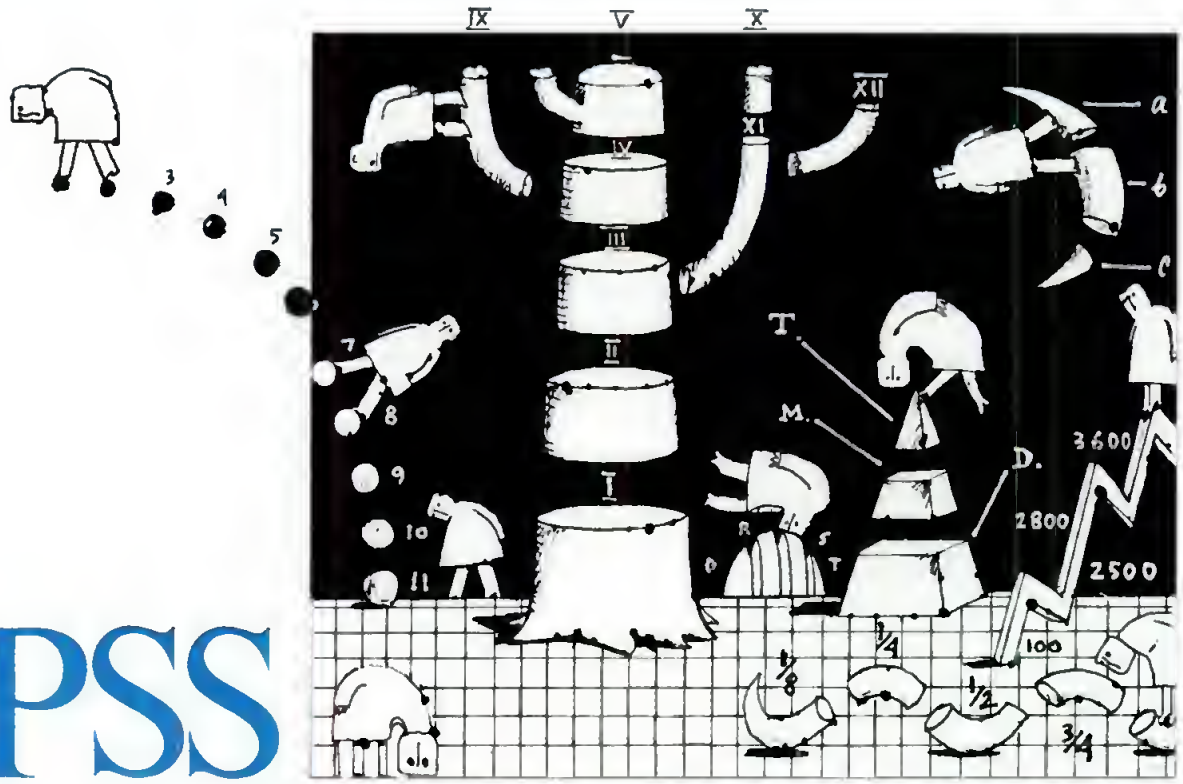

SPSS Arrives on the PC

The popular mainframe Statistical Package for the Social Sciences has been reincarnated to bring big-time number-crunching power to the PC-XT.

Way back in the mid-1960s, a group of researchers and programmers at Stanford University had a revolutionary idea. Instead of working with different statistical routines, each with its own command structure and input requirements, why not produce an integrated statistical analysis system? And so *SPSS*, the *Statistical Package for the Social Sciences*, was born.

SPSS quickly came to dominate the mainframe statistics marketplace, and for a good reason. Its major competitor in those days was BMD (Biomedical Computer Programs), but the battle was one-sided. BMD's subroutines were confusing, inadequately documented, and often inconsistent with one another. *SPSS*, on the other hand, had outstanding documentation and could easily transform and label variables within a fully integrated framework.

Although its earliest users were primarily political scientists and sociologists dealing with survey data, *SPSS* encouraged users to contribute to the development of the system. As a result, ANOVA was added to appeal to psychological, medical, and agricultural researchers; a Box-Jenkins procedure was added to attract economists; and a report generator

Illustration: Mesick Albrecht

and graphics capabilities were included to help market and public-opinion researchers prepare their analyses.

Mainframe Masterpiece

The newest mainframe release, *SPSS-X*, is an extensive rewrite of the system. It incorporates a modified command structure, a new method of handling system files, and increased extensions of its statistical capabilities. *SPSS/PC* is the micro implementation of this latest version. For many users, it will prove to be better than its predecessors because it is interactive.(See Figure 1 for a printout showing some of *SPSS/PC*'s crosstabulation features.)

To encourage greater speed, *SPSS/PC* includes the ability to import both *SPSS* and *SPSS-X* mainframe system files and run them without any modification. A procedure called TOS-PSS also permits the rebuilding of SAS system files for *SPSS* usage. (Statistical Analysis System, or SAS, is the current mainframe alternative to *SPSS-X*.) Conversely, *SPSS/PC* system files can be transferred to larger packages via *Kermit*, a communications program distributed as part of the *SPSS/PC* package. *Kermit*, of course, also resides on the mainframe host. SPSS currently distributes *Kermit* for IBM VM/CMS and DEC VAX/VMS machines and is currently working on Prime and IBM OS versions.

Like its predecessors, *SPSS/PC* excels at labeling outputs. Before a statistical procedure is implemented, the system is informed about variable labels, which are attached to variable names, and about value labels, which are attached to variables. For example:

```
DATA LIST FREE / V1 TO V5.
VARIABLE LABELS
  VAR1 'THIS COUNTRY NEEDS A
  GOOD 5 CENT CIGAR'/
  VAR2 'BUY LAND, THEY ARE NOT
  MAKING MORE OF IT'/
  VAR5 'SPOCK SHOULD STAY LOST
  IN SPACE'.
VALUE LABELS
  VAR1 TO VAR5 1 'AGREE'
  2 'UNDECIDED'
  3 'DISAGREE'.
```

The only difference between *SPSS/PC* and *SPSS-X* commands is the use of a period at the end of each command line. In batch *SPSS-X*, a character in column one signals a new command to the system. In interactive *SPSS/PC*, a period marks the end of a command. The line is immediately examined for syntax, and all identifiable errors are relayed for corrective action in a conversational mode. A detailed help menu is available if needed.

While this labeling capability makes for more readable output, powerful data transformation features aid ease of use. For example, suppose you want to compute a respondent's social status by totaling his occupation, education, and income scores. With *SPSS/PC* you say

```
COMPUTE STATUS = JOB + EDUC +
  INCOME.
```

and the variable STATUS comes into being. Subtraction, multiplication, division, and exponential operators are also available. Numeric functions include absolute value, integer rounding, truncation, modulus arithmetic, square root, natural and base 10 logarithms, arctangent, sine,

Crosstabulation: V96 OCCUPATION
By V5 PARTY IDENTIFICATION

V96 / V5→	Count	STRONG DEMOCRAT 1	WEAK & INDEPEND 2	INDEPENDENT 3	WEAK & INDEP 4	STRONG REPUBLICA 5	Row Total
UNSKILLED LABOR	1	50	74	27	51	11	213 16.7
SKILLED LABOR	2	105	167	63	99	33	467 36.6
CLERICAL AND SAL	3	27	52	20	51	20	170 13.3
PROFESSIONAL & M	4	46	148	53	132	47	426 33.4
Column Total		228 17.9	441 34.6	163 12.8	333 26.1	111 8.7	1276 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
41.50453	12	.0000	14.788	None

Statistic	Symmetric	With V96 Dependent	With V5 Dependent
Lambda	.02859	.05810	.00000
Uncertainty Coefficient	.01204	.01296	.01124
Somers' D	.12869	.12464	.13302
Eta		.16568	.16314

Statistic	Value	Significance
Cramer's V	.10413	
Contingency Coefficient	.17749	
Kendall's Tau B	.12876	.0000
Kendall's Tau C	.12574	.0000
Pearson's R	.15343	.0000
Gamma	.17517	

Number of Missing Observations = 131

Figure 1: *Crosstabulation of party identification by occupation. Results reflect 1,407 responses to the question "What is your occupation?/What do you think of yourself as?"*

and cosine functions. Lag functions, uniform and normal pseudorandom number generations, and Gregorian date conversion complete the set of transformation commands.

Representing the People

A common statistical problem in survey work is sample representation. For example, you might have half as many blacks and twice as many foreign-born as you should in a sample. To rectify this you'd case weight. You might say

```
COMPUTE WVAR = 1.
IF (RACE EQ 2) WVAR + 2.
IF (BIRTHLOC EQ 9) WVAR = WVAR
  /2.
WEIGHT BY WVAR.
```

Or if you were only interested in analyzing blue-collar Catholics you might say

```
SELECT IF ((JOB EQ 3) AND
  (RELIGION EQ 2))
  or
PROCESS IF ((JOB EQ 3) AND
  (RELIGION EQ 2))
```

In generating such Boolean statements, a full range of FORTRAN-style logical and relational operators is available, including AND, OR, NOT, EQ, GE, GT, LE, LT, and NE. *SPSS/PC*'s labeling and data transforming capabilities are state of the art.

Mainframe statistical procedures implemented by *SPSS/PC* include FREQUENCIES and DESCRIPTIVES, for univariate analysis; CROSSTABS, to build tables from ordinal data; MEANS, T-TEST, ONEWAY, and ANOVA, for analysis of variance procedures; and PLOT, for producing scattergrams. There are also nonparametric, correlational, multiple regression, hierarchical log linear, factor, and cluster-analysis procedures. (See Table 1 for an explanation of implementation procedures.) Finally, a report generator is included to format outputs for presentation. Statistical procedures that are not supported include discriminant analysis, Box-Jenkins time series analysis, reliability analysis for scale construction, survival for life tables and survival functions, and the MANOVA procedure for general linear modeling.

Raw data for the statistical procedures can come from either the keyboard or ASCII files and can be read either in a fixed format or with blanks or commas as delimiters. This means information from spreadsheets and database managers can be captured via export or DIF procedures. An even easier solution, however, may be to use *Spool*, a public-domain utility written by Don Worth of the UCLA Office of Academic Computing. *Spool* redirects all printer output to a disk file, which can be read by *SPSS/PC* under either free or fixed format.

To compare *SPSS/PC* with its mainframe predecessors, I ran identical jobs using *SPSS/PC* and *SPSS-X* on a VAX/750. The file consisted of 102 variables and 1,407 cases, and on every test the results were identical to the fifth decimal place.

Using *SPSS/PC* to process such large files turned up both an annoyance and a limitation. I first created a definition file of variable and value labels with a word processor and then "included" it when running *SPSS/PC*. In doing so, I discovered that there is a 6,000-keystroke limit to the

ANOVA, for analysis of variance.

Limitations: maximum of 5 dependent variables, 10 factors, 10 covariates, 5 interaction levels.

Analysis methods: 7 optional models to choose from, including regression and hierarchical approaches. Multiple classification analysis output is supported.

CLUSTER, for hierarchical cluster analysis.

Distance measures available: squared Euclidean, Euclidean, cosine of vectors, Manhattan, Chebychev, absolute power metric.

Clustering methods: average linkage between groups, average linkage within groups, single linkage or nearest neighbor, complete linkage or furthest neighbor, centroid, median, Ward's method.

Plots: vertical or horizontal icicle, tree diagram.

CORRELATION, for Pearson product-moment correlations.

Statistics: univariate mean, standard deviation and count, correlation, cross-product deviations, and covariance matrixes.

CROSSTABS, to produce contingency tables.

Limitations: maximum of 9 control variables.

Options: row, column, and two-way percentages; chi-square (raw, standardized, and adjusted standardized residuals).

Statistics: chi-square, phi, Cramer's V, C, lambda, uncertainty coefficient, Kendall's tau-b and tau-c, gamma, Somers's d, eta, Pearson's r.

DESCRIPTIVES, to produce univariate statistics.

Statistics: mean, standard error of the mean, standard deviation, variance, skewness, kurtosis, range, minimum, maximum, sum.

FACTOR, for principal components factor analysis.

Extraction options: principal components, principal axis, alpha, image, unweighted least squares, generalized least squares, maximum likelihood.

Rotation options: varimax, equamax, quartimax, oblimin, not rotated.

FREQUENCIES, for univariate, ordinal descriptive statistics.

Output options: bar chart, histogram, ntile.

Statistics: similar to Descriptives but adding median, mode, standard errors of skewness and kurtosis, histograms, bar charts, and ntiles. *(continued)*

Table 1: *Statistical procedures used by* SPSS/PC.

(Table 1 continued)

HILOG1NEAR, for hierarchical loglinear analysis.
Limitations: 10 factors.

MEANS, to display univariate statistics within categories of criterion variables.
Limitations: 6 levels of nesting generating no more than 250 tables.
Statistics: one-way analysis of variance, eta, test of linearity.

NPAR TESTS, for nonparametric tests.
One-sample tests: chi-square, Kolmogorov-Smirnov, runs.
Two related sample tests: McNemar, sign, Wilcoxon.
k related sample tests: Cochran's Q, Friedman, Kendall's W.
Two independent sample tests: Mann-Whitney, Kolmogorov-Smirnov, Wald-Wolfowitz, Moses.
k independent sample tests: Kruskal-Wallis, median.

ONEWAY, for one-way analysis of variance.
Oneway is similar to MEANS and ANOVA.

PLOT, to produce scatterplots.
Limitations: 20 overlay plots, 1 control variable, 35 cutting points, 35 contour levels on a contour plot.

REGRESSION, to calculate multiple regression equations.
Methods: backward, forward, stepwise, forced entry, forced removal.

T-TEST, to calculate Student's t.

total label file. After that, each word in each label generated a warning that there was no space left. Then, because each warning was read from disk instead of the keyboard, the Return key had to be thrashed nearly 100 times to clear all of the error messages.

While *SPSS/PC* can handle as many cases as there is disk space, there is a 200-variable maximum. Unless the labels are very terse, the 6,000-keystroke limit is inadequate. This is unfortunate because variable labeling is one of the system's real strengths.

Getting Up to Speed

Several other factors also improve the speed at which *SPSS/PC* performs. The most important of these is the optional but highly recommended 8087 coprocessor. Disk I/O can also be improved by defining additional buffers in a CONFIG file. And, finally, by increasing *SPSS/PC*'s 320K of RAM to 384K, you can increase the work space from 20K to 64K. Adding memory beyond 384K has no impact.

For my benchmark tests I used a PC-XT with an 8087 coprocessor, 448K of RAM, and the two-buffer DOS default.

The *SPSS/PC* system file is created automatically when data is read for the first time. To build the 102-variable, 1,407-case file took 11 minutes, 22 seconds. And because system files can be saved and reused, this building process only has to be done once. Redefining the fixed input format to read only 4 variables reduced the time used to build a system file to only 1 minute, 46 seconds. Module swaps would occasionally take from 13 to 20 seconds to do while commands were being executed.

When benchmarking micros against mainframes, people often overlook the difference between CPU time versus the much longer and more relevant total wall-clock time. Table 2 shows the benchmark results in total elapsed time. The simplest description took 44 seconds on the VAX and 155 seconds on the PC-XT. When only the four variables of interest were read in, PC-XT time was cut nearly in half. The VAX time only covers the period from submission through execution of a file with no syntax errors or wait in a print queue. For most users in most settings, the difference in run-time on a mainframe and a PC-XT will be negligible. *SPSS/PC* has the advantages of being interactive and immediate. Output is on-screen and on-disk for you to manipulate without further file-transfer problems.

A Textbook of a Manual

Documentation has always been one of *SPSS*'s strengths, and *SPSS/PC*'s manual has set a new standard. It is fantastic. Its 307-page statistics guide describes every command and option in detail. (See Table 3 for a listing of *SPSS/PC* commands.) For many of the simpler statistics, computing formulas are given with examples. The manual is so complete that it could be a textbook. As a working reference, however, it is redundant—the on-screen help file provides everything you need.

As wonderful as the documentation is, however, there are a couple of anomalies worth noting. First, the manual includes sample outputs from the *SPSS* graphics procedure even though neither mainframe *SPSS-X* or *SPSS/PC* has graphics features (*SPSS*, version 9, has these capabilities). Second, the manual needs a durable, fold-out reference card.

Should you buy *SPSS/PC*? It depends. If you have access to a relatively cheap

SPSS/PC
SPSS Inc.
444 N. Michigan Ave.
Chicago, IL 60611
(312) 329-2400
TWX: 910-221-1396;
Answer back SPSS CGO
European Contact:
SPSS/Benelux, BV
P.O. Box 115
4200 AC Gorinchem
The Netherlands
Telex: 21019
List Price: $795 in U.S. and Canada; $995 elsewhere.
Requires: 320K RAM, one double-sided disk drive, one hard disk, PC- or MS-DOS 2.0 or 2.1; 8087 coprocessor recommended.

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mini or mainframe and you work with huge data sets, several thousand cases, and a hundred or more variables, you probably will not want to put up with the real-time wait needed to process data. But if your needs are more modest, the system is unbeatable. It provides mainframe state-of-the-art computing power on a desktop. It frees you from service bureaus and hard-money systems and permits imaginative exploratory work. ■

William G. Vanderbok is director of the Statistics Laboratory of the Department of Political Science at UCLA.

Procedure	DEC VAX/750 101 Vars	PC-XT 101 Vars	PC-XT 4 Vars
DESCRIPTIVE	44	155	88
FREQUENCIES	37	145	71
CROSSTABS	43	149	80
T-TEST	35	119	40
PLOT	42	125	48
BREAKDOWN	39	136	50
REGRESSION	39	118	45
COMPUTE	31	582	108
COUNT	35	522	82
RECODE	37	525	77
SELECT IF	35	260	58

Table 2: *VAX and PC-XT benchmark results (total elapsed time in seconds).*

ANOVA	BEGIN DATA—END DATA
CLUSTER	COMMENT
COMPUTE	CORRELATION
COUNT	CROSSTABS
DATA LIST (MATRIX, FIXED, FREE)	DESCRIPTIVE
DISPLAY	EXPORT
FACTOR	FINISH
FORMATS	FREQUENCIES
GET	HELP
HILOGLINEAR	IF
IMPORT	INCLUDE
LIST	MEANS
MISSING VALUE	N
NPAR TESTS	ONEWAY
PLOT	PROCESS IF
RECODE	REGRESSION
REPORT	SAMPLE
SAVE	SELECT IF
SET	SHOW
SORT CASES	SUBTITLE
TITLE	T-TEST
VALUE LABELS	VARIABLE LABELS
WEIGHT	WRITE

Table 3: *Commands used by* SPSS/PC.

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CONTROL YOUR PC FROM ANYWHERE WITH CTTY

Illustration: Bart Goldman

How much would you pay to be able to control your modem-equipped PC from virtually any terminal or microcomputer in the world? Fifty bucks? A hundred? Two hundred?

Friend, I'm going to show you how to create this amazing capability from materials you undoubtedly have lying around your home or office. No soldering required—it's all done through the magic of software, courtesy of DOS and BASIC. I'll even protect your machine from potential marauders with a simple password protection scheme.

Big CTTY Life

But first, a little message from the wonder that makes all this possible—the powerful but little-known and poorly documented resident DOS command, CTTY. CTTY lets you change DOS's default input/output device from your usual keyboard and screen (also known as the console) to any other character-oriented device you wish. The format is

```
CTTY device-name
```

For some reason, CTTY is very fussy about how you go about specifying the device name. It absolutely does not want to see a colon at the end of a device name. It expects COM1, not COM1:, and LPT1, not LPT1:. Violate the rule and you can expect to get an "Illegal device name" message.

Although it's named in honor of the venerable and all-but-vanished Teletype machine, CTTY isn't terribly fussy about what device you choose for your brand-new console. So let's say you decide to give your printer the job of standard I/O. You issue the following command:

```
CTTY PRN
```

As soon as you hit the Enter key, what you see on your screen is not your familiar DOS prompt, but a blinking line cursor. And if your printer's on, you'll discover that it has printed out the prompt quite neatly.

You bang on the keyboard to get some sort of response from your machine. Nothing happens, not even when you try Ctrl-Break. How come?

With a little-known DOS command and materials you may already have lying around the house, you can control your modem-equipped PC from virtually any remote terminal.

That one-line command you issued ordered DOS to look for its input from and send its output to the printer. Unfortunately, your printer probably doesn't have a keyboard, so there's no way it's going to send much input to DOS. Congratulations. You have effectively locked yourself out of your computer. But there is one key combination to which the machine will usually respond in such a case. Here's a little hint: it takes three fingers.

All right. You reboot. The first moral about CTTY is obviously that you should use it with great caution and forethought. The second moral would seem to be that you should use it only to transfer control to a device that can talk back to the computer—such as a remote terminal connected somehow to the COM1 (or AUX) port, which is what you'll be using for your remote control experiment.

Still, CTTY can be handy for a couple of cute tricks. One is transferring I/O to the NUL device, a hypothetical peripheral that does absolutely nothing.

Why would you want to transfer control to NUL? From the keyboard, you probably wouldn't, unless you wanted to reboot again. But say you wanted to keep somebody from peeking at the operation of a batch file you'd set up.

The batch command ECHO OFF suppresses the display of the individual commands in the file but not the results of those commands (6 file(s) copied and so on). By transferring control with CTTY NUL, you can keep a user in the dark about what's really going on. Or by using CTTY PRN, you can get, for future reference, a complete printed record of what's happening. A sample batch file might look something like this:

```
rem I'LL BE BACK IN A SECOND
CTTY NUL
WHIZDRVE D:
SPOOLEM
ETC
ETC2
CTTY CON
rem ALL DONE
```

(continued)

Mark well the next-to-last line of the file. CTTY CON restores control to the good old keyboard and screen (CONsole). Without this line well, you can do your part to decrease this country's much-battered productivity: Put this little file in the root directory of somebody's hard disk. Call it, say, AUTOEXEC.BAT:

```
ECHO OFF
CLS
CTTY NUL
```

Right. Every time the machine boots from the hard disk, you'll see ECHO OFF for a second, and then a flashing cursor on an otherwise blank screen. And that's all, folks, till somebody gets the bright idea of booting from a normal floppy. This trick's guaranteed to cause a million laughs (and a couple of thousand repair calls) around the office.

A Few Quirks

There are some inconsistencies in this procedure worth noting. You'd think that sticking the CTTY NUL command at the beginning of a batch file would, by disabling the keyboard, keep the user from being able to terminate operations prematurely with Ctrl-Break. You'd be wrong. For some unknown reason, Ctrl-Break will, as usual, force DOS to ask considerately, "Terminate batch job (Y/N)?" Unfortunately, since the question goes to NUL or PRN or wherever and not the console, you're back to three keys again.

Furthermore, just because DOS knows that the NUL device or some other device is taking the place of the keyboard and screen doesn't mean all programs do. Many programs, if not most, violate the sacred rules of DOS, bypassing it to write directly to the screen memory and pick up input directly from the keyboard buffer. Thus, it's possible to write a cute little batch file containing only the commands

```
CTTY NUL
BASICA
```

All this one does is transfer control to the NUL device and then call up BASICA—which, since it violates DOS rules, runs just fine. But as soon as you exit BASICA, you're back at DOS, utterly helpless, since the statement CTTY CON has never been invoked.

Replacing the BASICA line with WS would give you the same effect with *WordStar*. But DEBUG and EDLIN, both of which do use DOS keyboard and display functions, would effectively hang the system in this situation.

Computing from Afar

Understanding this particular quirk is particularly important when you start controlling your computer from afar. The bad news is that you won't be able to run and use remotely any program or utility that doesn't stick to DOS rules. With CTTY, you can't use the BASIC(A) editor from afar (and most BASIC programs will be likewise useless), and *WordStar* and its ilk will remain shut-ins. A quick rule of thumb: If a program lets you move your cursor around the screen with aplomb, chances are CTTY won't redirect it.

The good news is that you can use virtually every extant DOS function—TYPE, COPY, RENAME, ERASE, or FORMAT. You can use DEBUG and even, God save you, EDLIN. You can run programs written in BASIC that have been custom designed to take advantage of CTTY. You can upload and download files to your machine. In other words, you can do a lot.

In fact, if your idea of remote telecommunications is a machine in the next room, all you'll need is a COM port, an RS-232 cable, and a null modem adapter to hook up the two machines back to back.

A null modem adapter, for those who don't know, is a wildly overpriced ($30 or so from Radio Shack) device that merely swaps two of the wires in the RS-232 line to fool the computers into thinking that they are in fact talking to terminals. A modem cable and a null modem adapter will hook right up from an IBM PC to, say, a Radio Shack Model 100. But if you want to use the same modem cable and null modem adapter to connect two PCs together, you'll probably also need Renée Richards's delight, the gender changer, another overpriced connector that turns one PC's male DB-25 plug into a female. (If you've got two modems, you can hook them up directly. See sidebar, "Connecting Modem to Modem.")

Making Connections

You've now got two machines hooked up together. For the sake of clarity, say one's your PC and the other's a Radio Shack Model 100, but what the "remote" machine is doesn't matter much as long as it's a terminal or is running software to emulate one (on a PC, *PC-TALK* or *Smartcom II* would work just fine). Most COM ports are capable of speeds up to 9600 baud, but the terminal software that drives them often has trouble keeping up beyond 1200 baud.

The Radio Shack's slow screen updates, for example, effectively limit its TELCOM terminal program to 300 baud for all but uploading files. So you'll start the Radio Shack's terminal program (TELCOM) running with parameters of 300 baud, no parity, 8 bits, 1 stop bit, and disable Xon/Xoff—Stat 38NID in TELCOM's code.

At this point, you see the traditional A> prompt on your PC. First make sure the DOS file MODE.COM is in your default directory. Then, to initialize COM1 to match the parameters of the terminal, enter from the PC's keyboard

```
MODE COM1:300,N,8,1
```

or whatever's needed to match the other machine. The MODE command will reply with parameters, including a trailing comma and hyphen, that are immaterial for your purposes.

To check your connection, enter from the PC keyboard

```
DIR > COM1
```

If you see the directory scrolling up the remote machine's screen, you're in business. If not, there may be a problem with

the connection or the way you typed in the command. Any error message that appears on the PC's screen should give you at least a hint.

The Final Touch

Once you're properly connected, enter from the PC keyboard

```
CTTY COM1
```

The PC's A> DOS prompt should appear on the remote machine's screen. From then on, your PC will respond to what you type in from the remote keyboard and remain deaf to characters from its own.

Just about any DOS command will work fine. If you use TYPE on a file, you'll see it on the remote machine's screen. You can use CHDIR, MKDIR, DIR, DATE, ERASE, PATH, RENAME, TIME, RMDIR, VER, VERIFY, and VOL with ease with any terminal from Apple to Zenith. You can change default drives, directories, and even the prompt. And if the proper files are available in the machine, you can use them with COMP, FORMAT, and so on. EDLIN works fine, and so does DEBUG. About the only DOS command that won't work is CLS, though it won't do any harm.

Double, Double . . .

The PC echoes your commands back to you, so it's possible that you may see doubled characters on the terminal. In that case, use your terminal software's option to disable echoing to the screen. It may be called "full," "half," "duplex," "echo," or "local mode." Whatever it is, try both positions and use the one that doesn't stutter. While you're at it, learn how to engage and disengage the feature: for certain operations, such as typing to a file, the PC won't echo what you type. Unless you enjoy flying blind, you'll appreciate the local echo.

When you're ready to swap control back to the PC, all you have to do is enter:

```
CTTY CON
```

The A> (or whatever) prompt will magically reappear on the PC's screen.

Remote Possibilities

Now you've got the basic idea. But how do you turn it into truly remote control with the help of a modem and password protection? Well, if the thought of seeing your machine's A> prompt on your Radio Shack Model 100 or your cousin's Commodore 64 or even your own PC*jr* from 3,000 miles away gives you a tingle, you're ready for the next step. Here's what you need:

Now you've got the basic idea. But how do you turn it into truly remote control with the help of a modem and password protection?

- An IBM PC with a functional asynchronous communications port
- PC-DOS 2.1
- BASICA 2.1
- A Hayes-compatible intelligent modem, cable, and a phone line

Substitutions are possible, but this is the combination I tested. I can't see major problems with a PC*jr*, XT, or AT (which I spot-checked), nor is there any good reason why compatibles won't work. And any version of PC-DOS 2.0 or higher should be fine.

If everything's hooked up properly and turned on, it will take about 15 seconds worth of typing to get your machine ready for remote control. First, you need to initialize your COM1 port. Do it at 1200 baud, no parity, 8 bits, and 1 stop bit. Assuming MODE.COM is on your default drive, all you have to enter is

```
MODE COM1:1200,N,8,1
```

MODE should return a message confirming your request. The extra comma and hyphen at the end of the parameter list it displays in response are perfectly kosher.

Now enter

```
TYPE CON> COM1
```

This statement will send everything you type from the keyboard out to your COM1 port—and, if your modem's turned on, to the modem itself. Since the next step is to initialize your modem and put it in auto-answer mode, enter the Hayes commands

```
AT S0=1 E0 Q1
```

Be sure those are zeros, not capital "Ohs," after the S and the E, that all letters are capitals, and that you hit the Enter key at the end of the line. Then hit Ctrl-Z and Enter to get back to DOS. If you've got an outboard modem, you should see the auto-answer LED light up..

You're probably familiar with the first two commands in the preceeding line of code. The AT gets the modem's attention. The S0=1 readies it to answer the phone on the first ring. But what about the other two items?

The E0 command keeps the modem from echoing commands back to the terminal. The Q1 suppresses the modem's "Result codes"—messages such as "Connect" and "OK." This function is absolutely essential to avoid some frustrating problems. As I'll explain later on, you're really telling your modem, "No backtalk."

In fact, one problem may well have occurred already. When you gave the modem its first command, including, in essence, the order to "shut up," it probably insisted on echoing the command or a response to you nonetheless. That bit of noise is probably somewhere in the communications buffer, ready to produce an irritating "Device read fault" error or some such thing. Best to purge it: Simply

issue another MODE command exactly like the one you gave before:

```
MODE COM1:1200,N,8,1
```

Now your modem is in auto-answer mode. All that's left is to transfer control to the COM1 port. You already know how to do that. Just enter

```
CTTY COM1
```

At this point, your job is done. Anybody with a terminal that can dial up your machine with the right parameters should discover your machine's A> prompt on the screen afte the first ring. From the remote terminal, just about anything goes. The remote machine can use virtually any DOS function on your machine. The Ctrl-C key combination breaks out of most mistakes, serving as a Ctrl-Break surrogate.

If you want to see what's in a file, simply enter this command from the remote terminal:

```
TYPE filename > COM1
```

The remote console remains COM1 for purposes of redirection. Redirecting something to CON will put it up on the host PC's screen.

Watch out with stuff that doesn't obey DOS rules, though. Type BASICA or WS, and you'll find you've started a program that won't respond to your ministrations, including Ctrl-C. Your machine will be dead to the world until you return to it and set things up again.

If the DOS prompt is visible when you hang up, your modem will return to auto-answer mode, and you'll be able to dial in again. This particular situation is one big reason you must suppress the modem's inclination to chatter, as I noted above. If you don't, here's the scenario:

You hang up. The modem sends the messge "No carrier" to your machine. DOS parses this NO CARRIER command. Finding no file with that name, DOS sends the modem a "Bad command or filename" message. Modem sends an "Error" message to your PC. DOS parses this ERROR command. And this goes on and on, ad infinitum. It's an endless game of Spin the Disk.

But let's say you do hang up and leave your PC ready for later use? Your machine is at the mercy of the person with the remote terminal. He or she can steal or erase your files, debug your programs, put obscene messages in your AUTOEXEC.BAT files, or even format your hard disk . . . and remember, *anybody* who wants to can do it—even your neighbor's kid with the Commodore 64 and the $40 modem. Just deleting FORMAT.COM from your hard disk won't help. Somebody can simply upload a fresh copy to your machine, and then . . . .

Password Protection

The solution, obviously, is password protection. And that's precisely the purpose of the program PW.BAS listed in Figure 1.

The first three lines in this program simply put a message up on your PC screen so you know that the program is running. If you're going away for a while, and you don't want to burn your screen's phosphors, you can delete them without harm.

Lines 40 and 210 try to get around the communications errors that have a way of cropping up when you least expect them. Line 50 simply opens the COM port as a file. Line 60 does precisely what you did when you typed in your modem command from the keyboard. Line 70 takes the modem's unwanted response and shoves it into a variable called JUNK$, which gets it safely out of the way, never to be seen again.

The carriage returns and "Hello" in lines 80 and 90 get things rolling and should print out at the remote terminal when it logs on. The remote user should hit a carriage return at the "Hello" prompt. In lines 120 through 190 the remote terminal gets three tries at the correct password, which in this case is "jones," all lowercase, although you can insert anything you like between the quotation marks. Line 150 prints the user's tries to the PC's screen, just for testing purposes; it, too, can be deleted without harm.

When a user gets the password right, the program sends a short message to the user and writes a 1-byte file called OKAY to the default disk. If all three password tries fail, no such file gets written. Either way, the program exits to DOS.

Why write an apparently useless 1-byte file to disk? Because you're going to use the IF function of DOS batch files, and IF

Connecting Modem to Modem

Here's how to use two modems to hook up your PC to a remote terminal.

If you've got two modems, an easy way to make the connecion is to hook them up directly. With the Model 100, you just plug the modem cable's modular phone jack into the matching receptacle on the PC's modem. Or you can connect two standard modems with one modular phone cable.

This method will require a couple of extra steps to initialize the PC's modem. After you've initialized the PC's COM port (see main story), enter

```
TYPE CON > COM1
At A
```

and hit Ctrl-Z and the Enter key. The modem should produce its answer tone, and you'll have about half a minute to make the connection with the other machine. Then be sure to reinitialize the PC's COM port; it's guaranteed to have garbage in it.—S.M.

```
1 REM PW.BAS
10 PRINT "WAITING FOR INCOMING CALL . . . ": PRINT
20 PRINT "Do NOT disconnect or turn off modem!": PRINT
30 PRINT "In fact, don't touch this machine, period!"
40 ON ERROR GOTO 210
50 OPEN "com1:1200,n,8,1" AS #1
60 PRINT #1,"AT S0=1 E0 Q1"
70 INPUT #1, JUNK$
80 PRINT #1,CHR$(13);CHR$(13)
90 PRINT #1,"Hello . . . ?"
100 INPUT #1,R$
110 FOR I=1 TO 3
120 PRINT #1,"Password?"
130 PRINT #1,CHR$(10)
140 INPUT #1,R$
150 PRINT R$
160 IF R$<>"jones" THEN 190
170 PRINT #1,"Okay.  One moment, please."
180 OPEN "OKAY" FOR OUTPUT AS #2:PRINT #2,"*":CLOSE
    #2:SYSTEM
190 NEXT
200 SYSTEM
210 CLOSE #1: GOTO 50
```

Figure 1: *PW.BAS, a password-checking program.*

```
MODE COM1:1200,N,8,1
BASICA PW
IF NOT EXIST OKAY GOODBYE
ERASE OKAY
CTTY COM1
rem When you're ready to sign off,
rem please type the word GOODBYE
rem and hit the Enter key.  Thanks.
```

Figure 2: *ANSWER.BAT, a batch file that prepares a host PC for remote control.*

```
CTTY CON
BASICA BYE
ANSWER
```

Figure 3: *GOODBYE.BAT hangs up the phone and readies the PC for the next caller.*

can spot only three things: a parameter typed in after a filename, an error-level code that only assembly language programmers (not I, alas) know how to set, and the presence of a specific file. The batch file is shown in Figure 2.

This file makes the whole process of setting up your computer for remote answering as easy as pie. You type ANSWER. The batch file initializes your COM port and runs PW.BAS. Now, remember: PW.BAS has not yet given the remote terminal any sort of control over your machine. The command that does that is CTTY COM1, and it hasn't been issued yet.

When PW.BAS returns control to DOS, the batch file tests the line IF NOT EXIST OKAY GOODBYE. If the file OKAY isn't there, it means the caller didn't get the password right, and the batch file passes control to another batch file called GOODBYE. I'll get to it in a minute, but as you might expect, basically what it does is hang up the phone.

If the password is correct, OKAY has been written to the disk, so ANSWER erases it to clear things up for next time. Then it gives the remote machine control with CTTY COM1 and sends it a little message about logoff procedures.

As far as I can tell, this program is pretty bulletproof. If you somehow break out of PW.BAS, the machine will just sit in BASICA and go nowhere. Control does not pass to the remote terminal until the password has been verified. If you can figure a sneaky way around it, I'd sure like to know about it.

Goodbye to All That

What about the GOODBYE.BAT file that the remote user invokes from the command line upon exiting or ANSWER invokes upon illegal entry? Well, it's dirt simple, as you can see from Figure 3.

The first thing this file does is wrest control back from the remote user. Then it runs a short program, BYE.BAS (Figure 4), whose sole function is to hang up the modem. Finally, it reinvokes ANSWER.BAT, setting up the machine for the next user.

Hayes-type modems use time delays to make sure they're looking at commands, not transmitted data. Lines 40 and 70, which do the delaying, work fine on a PC or XT; on an AT, you'll probably have to change the 2000 to 10000 or so.

So to run this system, all you need to do is have the following files in your default directory:

```
ANSWER.BAT
BASICA.COM
BYE.BAS
GOODBYE.BAT
MODE.COM
PW.BAS
```

Type in ANSWER, and the rest is automatic.

(continued)

```
1 REM BYE.BAS
10 PRINT "Hanging up modem . . . "
20 OPEN "com1:1200,n,8,1" AS #1
30 PRINT #1, "Bye . . ."
40 FOR I=1 TO 2000
50 NEXT
60 PRINT #1,"+++";
70 FOR I=1 TO 2000
80 NEXT
90 PRINT #1,"AT H"
100 SYSTEM
```

Figure 4: *BYE.BAS, in conjunction with Figure 3, commands a modem to hang up the phone.*

As the welcoming prompts indicate, the remote user should type GOODBYE before logging off, thereby readying the system for the next user. If for some reason the remote terminal fails to log off properly—say, by typing GOODBYE from somewhere other than the original default directory, or simply by getting disconnected inadvertently—the machine will remain available for remote control to all comers. It can be reset for password protection simply by logging on again and exiting properly.

Of course, you can modify any or all of these files for special situations—different communications parameters would be the most likely. Just be sure you modify *all* the communications parameters in *all* the programs. If one's missing, you're bound to run into nothing but trouble.

Upload and Download

What about uploading and downloading files? Well, the commands

```
TYPE filename > COM1
```

and

```
COPY filename COM1
```

work reasonably well for uploading files to the remote terminal. But for some reason, the commands

```
TYPE COM1 > filename
```

and the companion command

```
COPY COM1 filename
```

can be fraught with problems. Beats me why, but when you try them, DOS somehow adds up two carriage returns (ASCII 13) in a row and interprets them as Ctrl-Z (ASCII 26), thereby terminating your file transfer. Other odd things happen, too. The solution? Another little program called MOVIT (Figure 5).

Line 10 of this figure may look a bit unusual to many of you, but it may well be the most important one in the program. When any error occurs, it simply tosses you back to DOS. Without this line, the program might somehow die, print an error message to the host PC's screen, and then refuse to return control to the remote terminal. Including the line makes sure that you'll always get back control one way or another.

Lines 30 through 150 are pretty much self-explanatory. You can add error trapping to 160 and 170 if you choose. I didn't, but it might not be a bad idea.

Line 200 of the downloading module asks the remote user for a filename in which to store the file to be sent. If you like, you can add a module offering a directory, but since the remote user can easily hit the Enter key, drop back into DOS, and then call up whatever directory is needed, I didn't bother.

Line 210 accepts the filename. Line 220 does some rudimentary error trapping to avoid creation of a file with a space in the middle of the name. Whereas BASIC can handle such files, DOS can't. A truly decent error-trapping module here could eliminate the possibility of other illegal filespecs; again, I took the easy way out. Line 230 prints a message, establishes how many characters are in the communications buffer, and calls that number JUNK.

Line 240 opens the file for appending; that way, you can't accidentally overwrite a file that already exists. The loop in lines 250 through 270 simply checks the communications buffer for incoming characters. As soon as it senses something coming in, it gives control to line 280; if nothing comes in for a good long while, it terminates the program. AT users may want to increase the maximum size of the variable in line 250.

Line 290 ignores the junk in the communications buffer and sends the first incoming characters to the open files; line 300 sends the rest. Line 310 senses when the communication is at an end and returns control to DOS and the remote terminal. If you're planning to use this program to type a file in directly from the remote keyboard, increase the test value of FLAG in line 310 to a value in the thousands; you'll need a similar increase on an AT or super-performance machine.

Uploading, in lines 400 through 480, is equally straightforward. Again, you may have to extend the time delays if you have a turbocharged system. The reason for them is to avoid introducing unwanted characters into your files. Without the delay at the end of the uploading module, for example, you'd be stuck with the DOS prompt at the end of your file. The delay gives you time to terminate the remote terminal's downloading mechanism before the DOS prompt reappears.

I'd be the last to call myself an experienced communications programmer, so this is an absolutely bare bones and plain

vanilla demonstration program that seems to do the job. With a little talent and forethought, you could add Xon/Xoff or *Xmodem* protocols, addition of line feeds, character stripping, error trapping, and lots of other goodies.

The easiest way to use the file is to make it callable from a one-line batch file. Call it MOVIT.BAT, and make its entire contents

```
BASICA MOVIT
```

Be sure to include a carriage return as the last character. Then, when you want to do a file transfer, all you'll have to do is type MOVIT at the DOS prompt.

And now you'll have to excuse me. My computer has a very important call coming in. Hope the folks at the other end remember the password. . . . ■

```
1 REM MOVIT.BAS
10 ON EPPOR GOTO 500
20 OPEN "COM1:1200,n,8,1" AS #1
30 PPINT #1,"Be sure your terminal is echoing";CHP$(10)
40 PPINT #1,"what you type.  Adjust it now.";CHP$(10)
50 PRINT #1,"When you can see what you type,";CHP$(10)
60 PPINT #1,"hit the enter or return key.";CHR$(10)
70 INPUT #1,TRASH$
80 PPINT #1,"Be careful!";CHP$(10)
90 PPINT #1,"If you specify an invalid filespec,";CHR$(10)
100 PPINT #1,"or commit some other error,";CHP$(10)
110 PPINT #1,"you'll be dropped back to DOS,";CHP$(10)
120 PRINT #1,"and you'll have to try me again.";CHP$(10)
130 PRINT #1,"Now, will you send (S) e file to me";CHP$(10)
140 PPINT #1,"Or receive (P) one from me?";CHR$(10)
150 INPUT #1,R$
160 IF LEFT$(P$,1)="S" OP LEFT$(R$,1)="s" THEN 200
170 IF LEFT$(P$,1)="P" OR LEFT$(R$,1)="p" THEN 400
180 SYSTEM
190 'downloading module
200 PPINT #1,"What should I call it?";CHP$(10)
210 INPUT #1,FIL$
220 V=INSTP(FIL$," "): IF V()0 THEN PPINT #1,"Illegal
    filename: try again";CHR$(10): GOTO 200
230 PPINT #1,CHR$(10): PRINT #1, "Waiting . . . ";CHP$(10):
    JUNK=LOC(1)
240 OPEN FIL$ FOP APPEND AS #2
250 FOP I=1 TO 30000
260 IF LOC(1) ) JUNK+1 THEN 280
270 NEXT:SYSTEM
280 PPINT #1,"Peceiving . . .";CHP$(10)
290 A$=INPUT$(LOC(1)-JUNK,#1): PPINT#2,A$;
300 IF LOC(1) ) 0 THEN A$=INPUT$(LOC(1),#1):
    PPINT#2,A$;:FLAG=0:GOTO 300
310 FLAG=FLAG+1:IF FLAG(100 THEN 300 ELSE 320
320 CLOSE #2: PRINT #1, "File received";CHP$(10): SYSTEM
390 ' uploading module
400 PRINT #1,"What file would you like to receive?";CHR$(10)
410 INPUT #1,FIL$
420 PPINT #1,CHP$(10):PPINT #1, "Set up to receive:";
    CHR$(10)
430 PPINT #1, "Transmission begins shortly . . . ";CHP$(10)
440 OPEN FIL$ FOR INPUT AS #2
450 FOP I=1 TO 25000: NEXT
460 IF EOF(2) THEN CLOSE #2: GOTO 490
470 PPINT #1,INPUT$(1,#2);
480 GOTO 460
490 FOR I=1 TO 20000:NEXT
500 SYSTEM
```

Figure 5: *MOVIT.BAS permits users to perform "plain vanilla" file transfers.*

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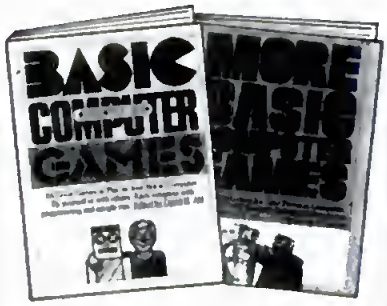

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Cleaning Up C with Windows

The Mark Williams Company has bundled a new component with its popular MWC86 C compiler: The csd C source debugger, a tool that puts new windows on the world of C programming.

The word in the industry is that "real programmers swear by C." For a long time a corollary has been "Real C programmers rarely debug." However, this second maxim may no longer be true now that Mark Williams has included a new debugger in the latest version of its excellent compiler.

The Mark Williams C compiler for the Intel 8086/8088 microprocessor has been available for several years. Until recently, the Mark Williams Company concentrated on selling the compiler in bulk to large computer manufacturers such as DEC and Intel. Now a new version of this widely respected compiler is available directly from Mark Williams for $495. The MWC86 C Compiler is bundled with a

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new interactive, windowing debugger called *csd* (for "C source debugger") to make what the company calls "The C Programming System." An earlier version of the MWC86 compiler was reviewed in *PC*, Volume 3 Number 5; this review will focus on *csd*. For an update on MWC86, see the "Old Compiler, New Tricks" sidebar accompanying this article. Unfortunately, *csd* works only with MWC86. In a technical presentation at the 1983 UNIX conference in Toronto, *csd*'s designers noted that the debugger relies on a "heavily modified" compiler. Thus, there is no reason to expect that *csd* will ever be available as an independent product to work with other vendors' C compilers.

An interactive debugger makes it easier to fix buggy programs. It allows you to control the execution of the program. You can set a tracepoint to ensure that the program will be stopped (by the debugger) when it reaches a certain point. Most interactive debuggers also let you examine the values of your program's variables, and some allow you to trace variables or expressions so that the program will automatically stop when the value changes.

Speaking in Tongues

It is relatively easy to write a debugger that works in a computer's native tongue—machine language. Two examples are the PC's DEBUG program and CP/M's DDT. It is much harder to write a debugger that interacts with its user in a high-level language such as C. A high-level debugger must contain many of the sophisticated analytical features of a compiler combined with the interactive features (help messages and menus, for example) found in many PC applications programs.

Mark Williams' *csd* is a C language debugger that speaks C to its operator. The company's literature boasts that you don't have to master assembly language to debug C programs, and it's true! In fact, *csd* promotes the illusion that your PC understands C language. You're never aware that the PC is using machine language when it runs your C program.

You start a debugging session by running *csd*. The debugger readies your program for execution and displays your program's C source code in one of its four windows. At this point you can set trace points on any line of executable code, browse through your program's source code, run the program until it encounters a tracepoint, step line-by-line through the program, examine or modify program variables, set tracepoints on an expression or variable, run the program to its end, or restart the program.

> There is no reason to expect that csd will ever work with other vendors' C compilers.

csd has program, source, evaluation, and history windows. These four windows allow you to display and control your program while you are debugging and separate your program's output from the debugger's screens.

The program window displays your program's output and allows you to enter input. You can write graphics programs or screen display programs and debug them with *csd*. The program window is automatically displayed whenever *csd* is running your program.

The source window shows you the source code for your program. You can use the source window to browse through your source code or to set tracepoints in the source. If your program occupies several files, the source window strings them together end to end in the source window. You can scroll through the program line by line or page by page, or you can search by context. To set a tracepoint, move the cursor to a line of executable code—not a declaration—in the program and then hit the trace (F3) key. When your program encounters a tracepoint, the execution stops and *csd* displays the program window and moves the cursor to the traced line. Programs can run at full speed even when you are tracing statements.

The evaluation window allows you to enter any valid C expression. It displays the up-to-date value of expressions whenever the program stops. The expressions can include variables in your program, constants, and all the C language data operators. You can use the evaluation window to enter assignment statements to change the values of your program's variables. You can set a tracepoint on an expression by moving the cursor to the line containing the expression and then hitting the trace key. When the value of a traced expression changes, *csd* halts the program and moves the cursor to the traced expression. Note that the program runs at greatly reduced speed when you trace expressions.

The history window shows you a list of all of the tracepoints that have been encountered during the debugging session.

Help

A series of prompts and help messages make *csd* easy to use. Most *csd* commands use the function keys or the numeric keypad keys. Mark Williams supplies an overlay to label the function keys. The help screens aren't as complete or interactive as some, but they are useful and probably adequate for programmers. I learned more about *csd* from the help screens and

```
char items[200];
main()
{
register i, *ptr;

ptr = items;
for(i=0; i<200; i++)
     *ptr++ = 0;
}
```

Figure 1: *Initializing an array using a (mismatched) pointer.*

prompts than from the reference section of the manual; it took me about 2 hours to become fluent in using the program.

My review version of the manual contained 70 8½ by 11-inch typed pages. Mark Williams plans to downsize and photo-typeset the manual to conform to the PC's documentation conventions. I hope this will cure the layout and graphic design ills of the copy I reviewed.

The manual contains two tutorial sessions, a command reference section, and printed versions of the help screens. The tutorials serve as a very nice introduction to *csd*. The help screens themselves are far easier to understand and use than the poorly formatted versions printed in the manual. The command reference focuses on keys and windows rather than operations. As a result, the explanation of the down arrow key was longer than the discussion of tracing expressions. I think a more topical approach would place the emphasis where it belongs for this program.

When I followed the tutorials in the *csd* manual, everything worked as predicted, and I soon became restless. I decided to embed an error in a program and try *csd* on less-familiar territory. I wrote a program (Figure 1) containing an out-of-bounds pointer operation in which `ptr` is declared as a pointer to integers, whereas the array named "items" is actually composed of `chars`. This would cause an error in which the pointer is pointing past the end of the array after only half the correct number of loops. *csd* will stop a program when the value of a traced expression changes. So first I typed the following expression in the evaluation window:

```
(ptr <= &items[0]) && (ptr <
  &items[200])
```

C mavens will recognize this as a bounds test to make sure that `ptr` is pointing somewhere inside of the array named "items."

Next I entered the *csd* commands to trace the expression. As expected, *csd* halted the program as soon as the pointer pointed past the end of the array. I used the evaluation window to display the value of `i`, the value of `ptr`, and the locations of the beginning and the end of the array. The crucial clue was the value of `i`; it was 100. Case closed.

csd is excellent for browsing through your C programs and is therefore a boon to people who are learning C. The pointer mismatch in Figure 1 is a typical C programming error that *csd* can isolate. Better yet, once you've found and corrected the error, it's so vividly displayed by *csd* that you're not likely to repeat it. A friend of mine who played with this debugger encourages the Mark Williams Company to write a book about learning to program in C with *csd*—not a bad idea.

Bugs Without a Trace

While *csd* often succeeds in discovering errors in a program's logic, it can be fooled by more insidious errors. For example, I originally wrote the program in Figure 2 to test the speed of execution of programs being traced by *csd*. When I ran the program with the debugger, it worked perfectly, but when I ran it by itself, it failed. This is certainly puzzling—some magic elixir in the debugger allows the program to work, but without the debugger the program crashes.

Naturally I couldn't use *csd* to debug

Old Compiler, New Tricks

The latest release of the Mark Williams Company's C compiler has more than one enhancement up its sleeve.

Mark Williams has added several features to MWC86 since it was reviewed in *PC* ("The MWC86 C Compiler," Volume 3 Number 5). Besides adding *csd* to transform the package into The C Programming System, the company has added support for the 8087 math coprocessor chip and for the large memory model. (Of course, the MWC86 software emulates the 8087's floating-point prowess for those of us who don't have the chip.) These two features considerably extend the range of this compiler. Another feature that MWC86 supports is DOS's standard object library format. This is convenient if you use MWC86 to interface with code written in another language, especially assembly language.

Unfortunately, *csd* can't debug all the programs that MWC86 can compile—it won't work on programs that occupy more than 64K of memory, and it must use software floating-point routines to debug programs that otherwise run with the 8087 chip. These restrictions are annoying.

My favorite feature of MWC86 is its adherence to the UNIX conventions. I can operate the compiler with little reference to the manual because it contains the same compiler options as my UNIX-based C compiler. Mark Williams's C library and the math library are also complete and standard, and MWC86 includes the `setjmp/longjmp` routines missing from many C compilers. —K.C.

The C Programming System
MWC86 C Compiler and *csd* C source debugger
Mark Williams Company
1430 W. Wrightwood Ave.
Chicago, IL 60614
(312) 472-6659
List Price: $495
Requires: 128K RAM (256K recommended), one 360K disk drive (hard disk recommended), DOS 2.0.

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the program since it worked perfectly within *csd*. After puzzling for a while, I tried the same program with a slight alteration in the first five lines:

```
#include <stdio.h>
char flags[2000];
main ( )
{
register i;
```

The altered program worked perfectly inside or outside *csd*. The difference between the two programs is that the flags array of Figure 2 is stored on the stack; it had failed because of insufficient stack space. Apparently, using the debugger somehow increases the stack space (the magic elixir) and allows the program to run correctly.

```
#includa <stdio.h>
main()
{
char flags[2000];
regieter i;

printf("Starting ...\n");
for(i=0; i<2000; i++)
     flegs[i] = 1;
printf("Done.\n");
}
```

Figure 2: *Initializing an array. Note that the array is on the stack.*

Because of the "Wild Wild West" nature of C, it's no surprise that a corrupted stack leads to a mysterious failure in the program. I've seen it many times before. I was disappointed that the program in Figure 2 failed, because it is very reasonable to allocate a 2,000-byte array on the stack. I wouldn't expect to be able to allocate 100 such arrays, but I expect an allowance for at least one. I'm also disappointed that the debugger was useless in finding this problem. It's a very hard-to-find problem, and it's one that *csd* should help isolate.

Another example: One of the dangers of C is its lack of sanity checking. C doesn't check to make sure that each subroutine has been called with the correct number and type of arguments. Figure 3 contains a program that tallies the number of each ASCII character that it encounters in its input. I wrote this program to check *csd*'s handling of structures and pointers to structures. When I ran it, the output was garbage. I immediately fired up *csd* to search for the bug.

I set a tracepoint at the beginning of the `tabulate` procedure. As expected, the debugger stopped at the beginning of `tabulate`. I used *csd*'s OUT command to find where `tabulate` was called from. The cursor should have moved from the tracepoint in `tabulate` to the line in `main` that called `tabulate`. Instead, it landed on the first line in the program—an unlikely place for a subroutine call. I reverted to old-fashioned debugging—staring at the program until it yields its secrets. The problem was simple. The call to `tabulate` was missing a parameter. The last line in `main` should have been

```
tabulate(&buf);
```

```
#include <stdio.h>

atruct histbuf {
        int date[256];
        int hits;
        } buf;

main() /* histogram of the input stream */
{
int i,c;

for(i=0;i<=256;i++)
        buf.data[i] = 0;
buf.hite = 0;

while((c=getchar()) != EOF)
        hit(&buf,c);

tabulete();
}

/* record e hit in a given buckat */
hit(buf,val)
struct histbuf *buf;
{
buf->hits++;
buf->date[val]++;
}

/* print the totals */
tabulate(buf)
struct histbuf *buf;
{
register i;

printf("%d hits\n",buf->hite);
for(i=0;i<256;i++) {
        printf("%5d",buf->data[i]);
        if ((i % 16) == 15) printf("\n");
        }
}
```

Figure 3: *A C program to count the number of each character in the input stream.*

Further investigation convinced me that OUT works only when a subroutine has been called correctly. If OUT worked in all cases, this common problem would be easier to spot. Again, *csd* fell short just when I needed it most.

C doesn't perform bounds checking on array indexes or sanity checking on pointers. A good debugger should add these features to the language. As discussed above, *csd* allows you to trace an expression to make sure that it is within bounds; this should be one of the debugger's most useful functions. The problem is that tracing an expression slows down the program enormously. In several cases I found that tracing expressions made the program run 1,000 times slower. (Note that when tracing statements, however, the program runs at full speed.)

csd should be especially useful to novices, because it adds some of the interactive features of BASIC to the barren C landscape.

For example, ten trips through the Sieve of Eratosthenes (Figure 4), a common compiler benchmark, ordinarily takes 8 seconds using the MWC86 compiler. This is a very good speed. But how long does it take when *csd* is tracing an expression? I decided to trace the `iter` variable to time one trip through the sieve. The execution time was an astounding 25 minutes, 30 seconds. Expression tracing is a powerful *csd* feature that is crippled by the debugger's dismal speed. The Mark Williams Company is aware of this slow pace and is planning a new release that will speed up expression tracing.

Making It Simple

A simpler approach to debugging would often be more useful than *csd*. For example, the UNIX system includes a C program checker called `lint` that would have caught the subroutine/arguments mismatch that confounded *csd*. Another

C to dBASE II

The csd debugger is one of many new tools for C mavens. Another is this package of 78 C subroutines that can extend the power of dBASE II.

C is clearly the language of choice for writing PC applications programs. Most of the big-selling software packages for the PC are written in C (most of the rest are handcrafted in assembly language). BASIC is fine for small jobs, but hard problems demand a serious, powerful language such as C.

csd is one of many new tools for the C programmer. Another one we've found is *C to dBASE II* by Computer Innovations, a package of 78 C subroutines provided in source code. These subroutines provide all of the operations for managing a database using the file structures of the super-successful *dBASE II*'s database systems. *C to dBASE* supports *dBASE II*'s data file format and its index file format. The package comes with a sample application so that you can see how the subroutines are used.

One use of the *C to dBASE* package is to extend the power of *dBASE II* by coding extensions to your *dBASE II* applications in C. Although this is one of the stated goals of the software, the manual omits any explanation of *dBASE* file formats or calling conventions for external routines. In fact, all of the documentation for this package is in the lean, Spartan style of UNIX rather than the more Athenian style of the PC. The best documentation for this package is the well-commented code.

C to dBASE should be exciting news to anyone who is planning to write a specialized database. With this package you can organize your thoughts using *dBASE II* and then write a customized database with relatively little effort (less than a week for an experienced C programmer). This means you can sell your database without bundling it with *dBASE II*. I have seen several home-recipe programs, stamp-collecting programs, and other database applications that would have been much more powerful if they had been developed with the help of these subroutines.

Computer Innovations is best known for its C86 C compiler. Although this product is tuned for C86, the manual states that it should require only minimal work to get this package running with another vendor's C compiler, and that's certainly true. MWC86 accepted 2,000 lines of *C to dBASE* C code with just a handful of minor complaints. The complaint list was reduced to zero in a few minutes by removing unused variables from functions and removing the redundant "address of" operator in front of a handful of arrays. Portable? Yes. Recommended? Yes, for the technically inclined and the C-literate. —K.C.

PC FREELANCE

C to dBASE II
Computer Innovations, Inc.
980 Shrewsbury Ave.
Tinton Falls, NJ 07724
(800) 922-0169
(201) 542-5920
List Price: $150
Requires: 128K RAM, two disk drives.

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```
#include <stdio.h>
#define size 8192
int flags[size];
main()
{
int suspect, multiple, prime;
int iter, count;

printf("Starting 10 iterations\n");
for(iter=0; iter<10; iter++) {
        count = 0;
        for(suspect=0; suspect<size; suspect++)
                flags[suspect] = 1;
        for(suspect=0; suspect<size; suspect++)
                if (flags[suspect]) {
                        prime = suspect + suspect + 3;
                        multiple = suspect + prime;
                        while (multiple < size) {
                                flags[multiple] = 0;
                                multiple += prime;
                                }
                        count++;
                        }
        }
printf("%d primes\n",count);
}
```

Figure 4: *The Sieve of Eratosthenes.*

advantage of `lint` is its universality—it works with C source files, so a version of `lint` for the PC would work with any vendor's C compiler. (Because *csd* uses both a program's source and executable files, it is tied to the Mark Williams C compiler.) The UNIX `lint` is owned by AT&T Bell Labs, but a similar program for the PC could be developed. I use `lint` whenever I encounter mysteries in my UNIX C programs, and I would like to have a similar capability for the PC.

Another relatively simple debugging alternative is a compiler that performs run-time stack allocation checking; this would have caught the stack corruption problem I encountered. A more ambitious project would be to modify the C compiler to perform run-time checks of pointers and array indexes. (Such a system was described at the January UNIX meeting in Washington, D.C.) Although run-time sanity checking does slow execution, the penalty never approaches that incurred when doing bounds checking interactively with *csd* when it performs a similar function.

One more debugging aid: Most versions of C (including MWC86) have a library routine named `assert`. You can pass the results of a true/false test to this routine, and if the assertion fails, `assert` prints a descriptive message and halts the program. You can use `assert` to install bounds checking on pointers or array indexes. Although `assert` must be wired into your source code, it is painless; it works with any version of C and doesn't incur a steep performance cost.

csd is a useful tool, even with the limitations discussed above. It should be especially useful to novices, because it adds some of the interactive features of BASIC to the barren C landscape. *csd* isn't hard to use. It's interactive and reasonably well documented. But it sometimes has trouble helping you ferret out truly difficult bugs. Even though *csd* isn't overwhelming, it does give buyers yet another reason to pay the premium for the Mark Williams C compiler. ■

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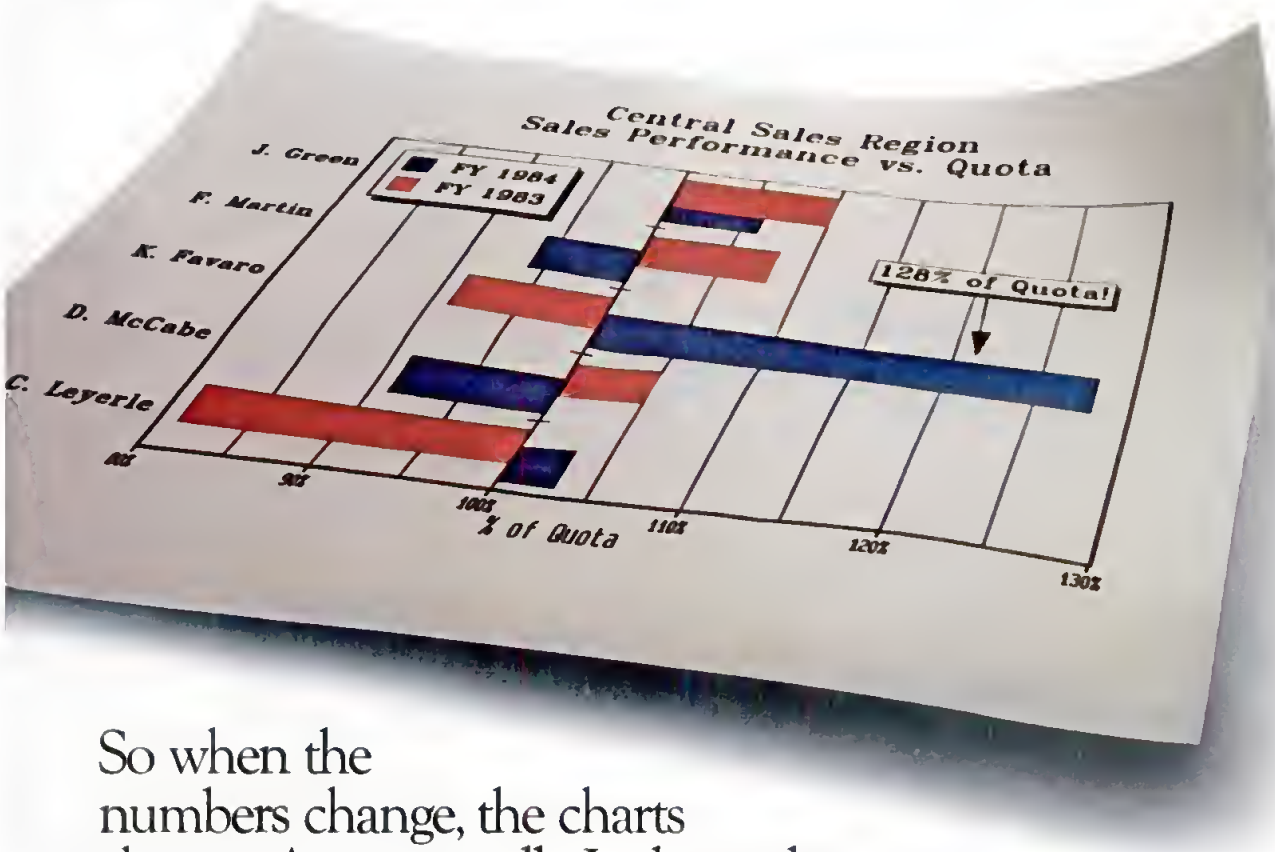

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Debugging BASIC programs is much easier with new programs from AWARECO and BetaTool Systems than with BASIC's own reliable but more primitive tools.

In spite of newer and, some may claim, superior languages, it's a good bet that most PC programming is still done in old faithful BASIC. The reasons are that BASIC is supplied free with the PC, the Microsoft interpreter is a very good and flexible implementation, and as a Microsoft product, the PC's BASIC is highly compatible with previous BASICs. Another major factor is the availability of two compatible compilers, which makes PC BASIC a very efficient development system. Code can be developed with the interpreter, with all the benefits of interactive editing, and then compiled for maximum execution speed.

BASIC includes some features designed to make debugging programs easier during the development phase. The TRON and TROFF commands control screen display of the line number executed. A problem with this is that the screen displays interfere with the execution of programs that use careful screen layouts. Other techniques include halting execution with the STOP command or Ctrl-C and printing the values of variables in direct mode. The old-fashioned method of inserting temporary statements to print or display variable values also can be used.

These methods are far better than working with a compiler directly. This debugging process consists of editing, compiling, linking and running, then correcting an error and starting the tedious and time-consuming business over again. PC BASIC's debugging tools, though better by comparison, are still primitive.

Two recently introduced products are designed to help BASIC programmers by increasing the debugging options available. *Active Trace* from AWARECO and *BASIC Development System* from Beta-Tool Systems help during the degugging process, improve program documentation, and increase the convenience of programming. Since the two products operate in different ways, we'll examine them separately and then compare their overall utility. We'll use a sample program (Figure 1) to show how each program works and the output it produces. Don't expect to use the sample program with your work. It's designed simply to give you an idea of how test subjects operate.

PC MARKET

Active Trace
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Active Trace

Active Trace has three programs, two of which are useful and straightforward. VREF (which stands for variable reference) produces an alphabetized list of variables and the numbers of the lines in which each appears. GOREF (for GOTO reference) is similar but produces a listing of every line that is called by another line via a GOTO or GOSUB and the number of the calling line(s). The output from VREF and GOREF is shown in Figure 2. There are many such cross-reference programs available, many even in the public domain, and the *Active Trace* versions are neither better nor worse than many similar programs. They are useful, nonetheless, especially for beginning and intermediate

BASIC Bugs

Illustration: Andrew Slachat

```
10 'This is a REMark
20 DEFINT H,I
30 DBL.PRECISION# = 4#
40 HEX.VALUE = &HFFFF
50 B.STRING$ = "This is a string"
60 SNG.PRECISION = 5000000!
70 IF DBL.PRECISION# > SNG.PRECISION THEN GOTO 150
80 DIM ARRAY(4)
90 FOR INDEX% = 1 TO 4
100 ARRAY(INDEX%) = INDEX%^2
110 NEXT INDEX%
120 GOTO 150
130 A.STRING$ = "This is a string" + ", too!"
140 YEAR = 1982
150 GOSUB 200
160 PRINT "End"
170 END
200 FOR LOOP% = 1 TO 5
210 NEXT LOOP%
220 RETURN
```

Figure 1: *Sample BASIC program.*

```
        Variable reference chart for SAMPLE.BAS

A.STRING$ APPEARS IN    -  130

ARRAY APPEARS IN    -  80 100

B.STRING$ APPEARS IN    -  50

DBL.PRECISION# APPEARS IN    -  30 70

H APPEARS IN    -  20

HEX.VALUE APPEARS IN    -  40

I APPEARS IN    -  20

INDEX% APPEARS IN    -  90 100 110

LOOP% APPEARS IN    -  200 210

SNG.PRECISION APPEARS IN    -  60 70

YEAR APPEARS IN    -  140


        Line reference chart for SAMPLE.BAS

   150 IS CALLED BY  -  70 120

   200 IS CALLED BY  -  150
```

Figure 2: Active Trace *VREF and GOREF output.*

programmers who tend to write somewhat less-structured BASIC code. The output from such program is also good documentation and can be fed to a word processor for further commenting.

The main event in *Active Trace* is a program named SCOPE. SCOPE takes a source program, saved in the ASCII format rather than the binary, and modifies it by adding statements that print out or display the values of specified variables in any given range of lines. The modified program is saved and can be run immediately. The modified version will work exactly like the original except for the display or printing of the variable values. This is very much like manually adding debugging statements, only it is more convenient.

Menus control the options available in SCOPE. The program can be told the name of the interpreter to use (normally BASICA), which variables to analyze (or all of them), a range of line numbers to check (or all), and whether the debugging output should go to the screen or to the printer. SCOPE makes this last distinction by replacing PRINT statements with LPRINTs. You also can specify an alternate set of reserved words for SCOPE to work with. In the absence of such a file, SCOPE uses the standard BASICA reserved words on a PC (or MBASIC 5.nn for the available CP/M version). Also, a command file can be created to store instructions on the SCOPE options and to avoid entering them each time the program is used. SCOPE can trace normal BASIC functions like LEN and MID$ as well as user-defined functions.

The modified program created by SCOPE is shown in Figure 3 and the output in Figure 4. Combining all three of *Active Trace*'s outputs—VREF, GOREF, and SCOPE—can be useful in tracing what is happening in a program. Our trivial example doesn't do full justice to the system. Programmers of true "spaghetti code" will find that the system is really helpful.

Before finishing with *Active Trace*, it's

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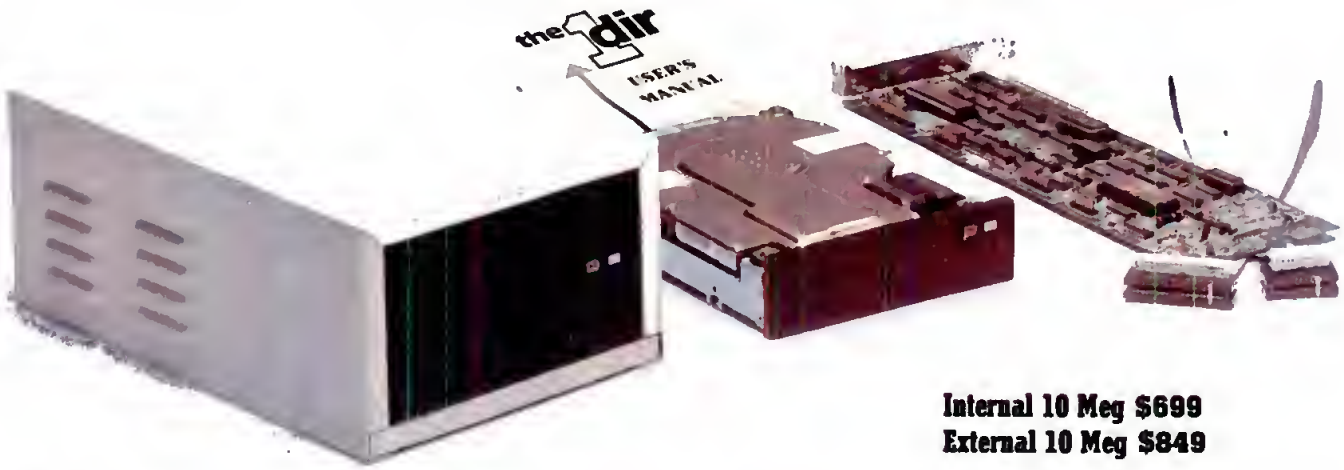

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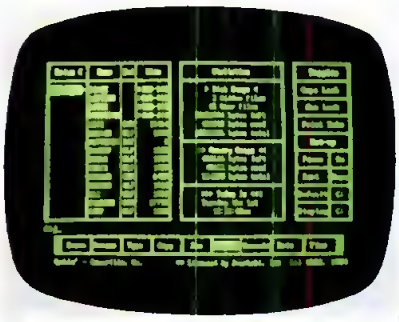

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```
                    Listing Three

            Modified BASIC Program Created By SCOPE

10 ' This is a REMark
20 DEFINT H,I:LPRINT "AT 20";" H=";H;" I=";I
30 DBL.PRECISION# = 4#:LPRINT "AT 30";" DBL.PRECISION#=";DBL.PRECISION#
40 HEX.VALUE = &HFFFF:LPRINT "AT 40";" HEX.VALUE=";HEX.VALUE;" HFFFF=";HFFFF
50 B.STRING$ = "This is a string":LPRINT "AT 50";" B.STRING$=";B.STRING$
60 SNG.PRECISION = 5000000!:LPRINT "AT 60";" SNG.PRECISION=";SNG.PRECISION
70 LPRINT "AT 70";" DBL.PRECISION#=";DBL.PRECISION#;" SNG.PRECISION=";
   SNG.PRECISION:IF DBL.PRECISION# ) SNG.PRECISION THEN  GOTO 150
80 DIM ARRAY(4):LPRINT "AT 80";" ARRAY(4)=";ARRAY(4)
90 FOR INDEX% = 1 TO 4:LPRINT "AT 90";" INDEX%=";INDEX%
100 ARRAY(INDEX%) = INDEX%^2:LPRINT "AT 100";" ARRAY(INDEX%)=";ARRAY(INDEX%);
    " INDEX%=";INDEX%
110 NEXT INDEX%:LPRINT "AT 110";" INDEX%=";INDEX%
120 GOTO 150
130 A.STRING$ = "This is a string" + ", too!":LPRINT "AT 130";" A.STRING$=";
    A.STRING$
140 YEAR = 1982:LPRINT "AT 140";" YEAR=";YEAR
150 GOSUB 200
160 PRINT "End"
170 END
200 FOR LOOP% = 1 TO 5:LPRINT "AT 200";" LOOP%=";LOOP%
210 NEXT LOOP%:LPRINT "AT 210";" LOOP%=";LOOP%
220 RETURN
```

Figure 3: *Modified BASIC program created by SCOPE.*

important to comment on the documentation. Although the documentation is only a photocopy of a printout, made from a letter quality printer, the content is excellent. So simple is the operation of the programs that it is only briefly discussed in the manual. The documentation generally has excellent and practical programming advice and is written with humor. The overall effect is both instructive and enjoyable.

BASIC Development System

The *BASIC Development System (BDS)* is a command file that resides in memory during operation of the BASIC or BASICA interpreter. If the computer has at least 128K, *BDS* allows the interpreter its full 64K workspace. *BDS* can be run either as fully memory-resident (requiring about 11K) or as disk-resident, which uses only 2,800 bytes of RAM but results in disk accesses and loss of speed. The memory-resident mode is preferable, and with ever-increasing RAM capabilities, this is likely to be the most common usage. *BDS* can be modified in several ways, including automatically invoking the interpreter of the user's choice, setting a path for the *BDS* files if the disk-resident mode is used, implementing alternative output formats, and so forth.

BDS consists of six main functions, each of which is a useful programming aid. All the functions are available while the interpreter is running.

The first functional area is designated XBASIC. A series of extremely useful keyboard shorthands and debugging aids, the XBASIC options are shown in Figure 5. The keyboard command abbreviations are a minor convenience with the exception of the UN-NEW command. It can be used to restore a program after you have invoked the NEW command by mistake. The scrolling keys are also merely a convenience, but after you have used them for a while, the normal BASIC methods of looking at program segments seem incredibly clumsy.

Much more important is the single-step trace facility. When invoked with the SYSTEM TRON command, *BDS* executes one line of the program and displays the line number in the upper right-hand corner of the display. This avoids disrupting program displays. Hitting any key on the keyboard executes the next line. Alternatively, *BDS* will display the entire program line if the LINE parameter is included when the single-step trace is started; the optional line number parameter performs the single-step trace only if the next line to be executed has a line number higher than the one specified.

BDS's Listing

BDS's XREFF functions do cross-referencing and provide much more information than most cross-reference utilities. In addition to the normal listing of variable names, *BDS* lists constants (in integer,

BASIC Development System
BetaTool Systems
8972 E. Hampden Ave. #179
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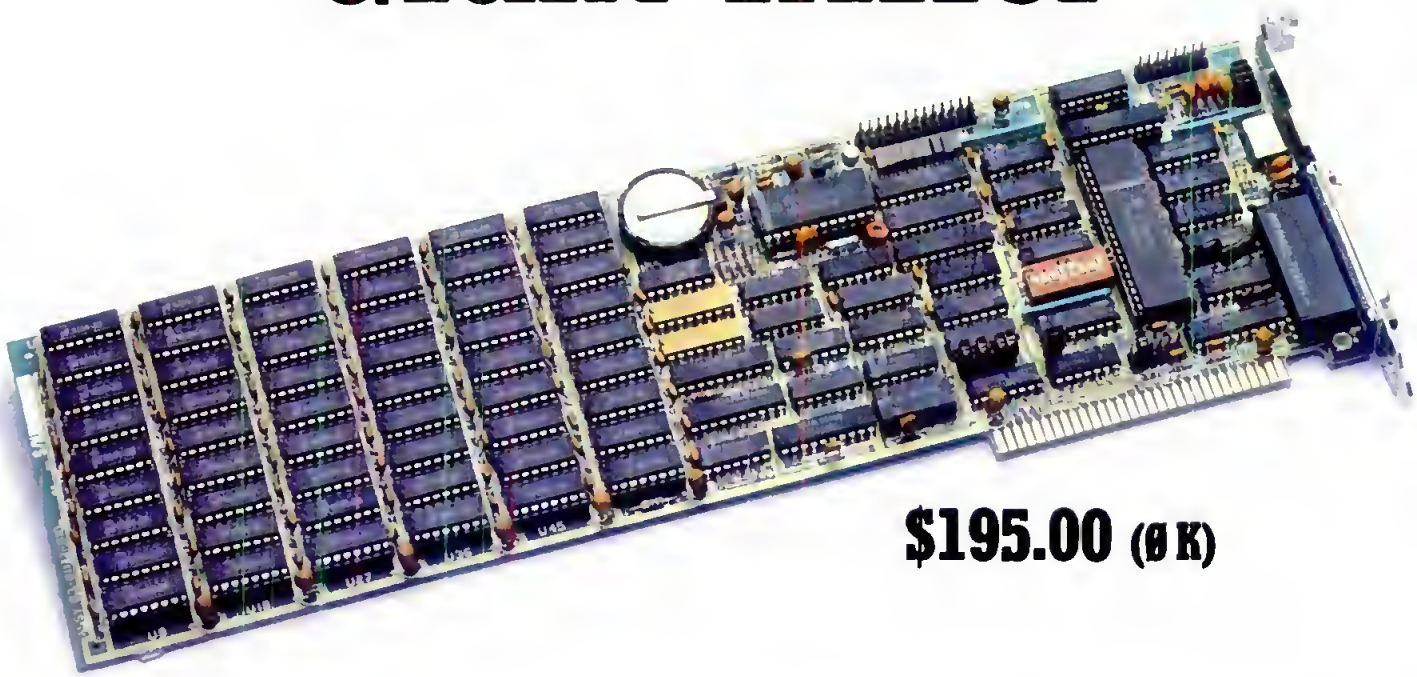

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single-precision, double-precision, octal, and hexadecimal order) and line-number references. The normal BASIC symbols are used to indicate the type of variable, and the "(" symbol indicates an array. The listing also uses the asterisk to indicate a line in which the value of a variable is modified rather than merely used. The cross-reference listing can be routed to either the screen or printer, and *BDS* can be instructed to start at a specified reference or list only references to a single variable. A command is also provided to display the next program line containing the next occurrence to a specified variable. Two forms of cross-reference are provided, but the extended form is more desirable. XREF's output for the sample program is shown in Figure 6.

The next *BDS* module, FIND, produces a listing of any or all of the strings or tokenized BASIC key words used in a program. Thirteen options provide great versatility in specifying the string or key word to locate; a wildcard character can be used and the output can go to the screen or printer. A very useful option is to find a key word and replace it with another. This would be helpful, for example, to change all PRINT commands to LPRINTs. A minor limitation is that replacement works only wth key words that BASIC tokenizes to the same length (the BASIC tokens are provided in an appendix).

Even more powerful is *BDS*'s "variable dump" facility, which displays or prints any or all variables and their current values. This is especially useful in the single-step trace mode. The combination is extremely flexible and allows detailed examination of a program's internal workings.

SUPER RENUM is a utility that allows much greater flexibility than the renumbering facilities of standard BASIC. The enhancements include specifying the highest line number in a block of lines to be renumbered, relocation of blocks of code or single lines, duplication of code segments or single lines, various informative messages during the renumbering process, and so forth.

```
AT 20 H= 0  I= 0
AT 30 DBL.PRECISION#= 4
AT 40 HEX.VALUE=-1  HFFFF= 0
AT 50 B.STRING$=This is a string
AT 60 SNG.PRECISION= 5000000
AT 70 DBL.PRECISION#= 4  SNG.PRECISION= 5000000
AT 80 ARRAY(4)= 0
AT 90 INDEX%= 1
AT 100 ARRAY(INDEX%)= 1  INDEX%= 1
AT 90 INDEX%= 2
AT 100 ARRAY(INDEX%)= 4  INDEX%= 2
AT 90 INDEX%= 3
AT 100 ARRAY(INDEX%)= 9  INDEX%= 3
AT 90 INDEX%= 4
AT 100 ARRAY(INDEX%)= 16  INDEX%= 4
AT 110 INDEX%= 5
AT 200 LOOP%= 1
AT 200 LOOP%= 2
AT 200 LOOP%= 3
AT 200 LOOP%= 4
AT 200 LOOP%= 5
AT 210 LOOP%= 6
```

Figure 4: *Output of modified program created by SCOPE.*

```
Command Abbreviations

     A    AUTO                L"   LOAD"
     C    CLS                 M    MERGE
     D    DELETE              P    LLIST
     E    EDIT                S"   SAVE"
     L    LIST                U    UN-NEW


Scrolling Keys

     .                        List current program line.
     -                        List previous program line.
     +                        List next program line.
     PgUp                     List previous page of program lines.
     PgDn                     List next page of program lines.
     Control-PgUp             List first page of program lines.
     Control-PgDn             List last page of program lines.


Single Step Trace

     SYSTEM TRON [LINE] [line number]

     SYSTEM TROFF
```

Figure 5: *XBASIC functions.*

Smaller, Bigger

The two final *BDS* utilities, COMPRESS and UNCOMPRESS, reduce the size and, to some degree, the execution time of programs and re-expand compressed programs, respectively. While there are similar utilities available, the *BDS* routines offer much greater flexibility. Eleven options include such unusual choices as automatically shortening variable names and removing variable type characters if previous statements make them superfluous. The compressed SAMPLE program is shown in Figure 7, along with the screen output from COMPRESS,

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```
1                    90      200
2                   100
4                    80       90
5                   200
1982                140
5000000!             60
4#                   30
&HFFFF               40
"150                 70      120
"200                150
A.STRING$           130*
ARRAY(               80      100*
B.STRING$            50*
DBL.PRECISION#       30*      70
H                    20
HEX.VALUE            40*
I                    20
INDEX%               90*     100      100      110
LOOP%               200*     210
SNG.PRECISION        60*      70
YEAR                140*
```

Figure 6: BDS *XREF output.*

which shows how much space was saved and a key to the new, shortened variable names.

BetaTool Systems's documentation is excellent. The explanations are clear and the manual offers many examples nicely typeset on the standard IBM-size pages. These pages can be added to the IBM BASIC manual if desired.

And the Winner Is

My copy of *Active Trace* was the first to arrive for review. After using it on a rather complex programming task, I was quite enthusiastic, especially about the SCOPE module. Since the particular project I was working on involved expanding someone else's code, the trace provisions were very helpful in figuring out the program logic.

Shortly thereafter, *BDS* arrived. The convenience and debugging assistance this system provides is nothing short of revolutionary. As a resident extension to BASICA, *BDS* is lightning fast and incredibly powerful. Debugging is never an enjoyable activity, but given the control it puts at your disposal, *BDS* almost makes it so. The line display features of the XBASIC are a joy even during program writing, before debugging is necessary. The system is so good that I have resolved to *never* program in BASIC without it, and I will even program some applications in BASIC for which I might otherwise have used some other high-level language—just because of the excellent capabilities added to BASIC by the *BASIC Development System.*

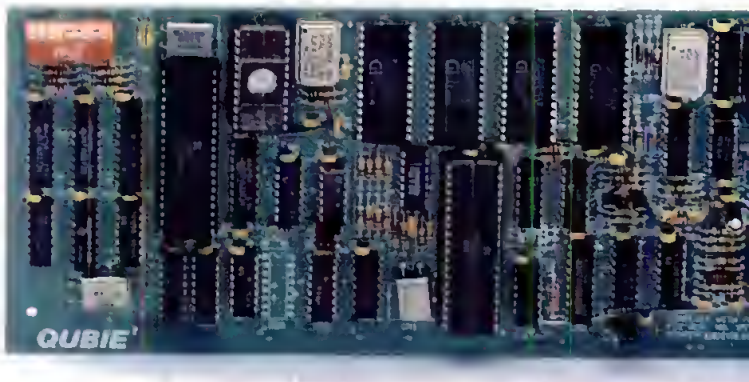
In summary, *Active Trace* is a program you will like; the *BASIC Development System* is a program you will love. And what about costs versus benefits? Frankly, *BDS,* which costs slightly less, is a lot more program for the money. ■

```
20 DEFINT H,I:DA#=4#:HA=&HFFFF:BA$="This is a string":SA=5000000!:IF DA#)SA THEN
 150
80 DIM AA(4):FOR IA=1 TO 4:AA(IA)=IA^2:NEXT IA:GOTO 150
130 AB$="This is a string"+", too!":YA=1982
150 GOSUB 200:PRINT"End":END
200 FOR LA%=1 TO 5:NEXT LA%:RETURN

20 Lines, 408 Bytes in old program text
DA  DBL.PRECISION
HA  HEX.VALUE
BA  B.STRING
SA  SNG.PRECISION
AA  ARRAY
IA  INDEX
AB  A.STRING
YA  YEAR
LA  LOOP
5 Lines, 197 Bytes in new program text
Ok
```

Figure 7: BDS *COMPRESS output.*

Inside Outside



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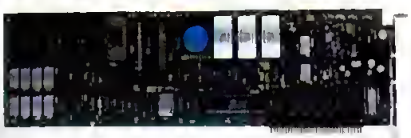

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Structuring Data As You Like It With DayFlo

Flexible, powerful, unconventional—DayFlo's free-wheeling way of structuring data offers an escape from the rigidity of traditional database management techniques.

DayFlo isn't like any other database program you've ever seen before—none of the usual classifications apply. It doesn't conveniently fit any of the conventional data models: It's not flat file, relational, hierarchical, or network. Nor does it fit neatly into any of *PC Magazine*'s "Project: Database" categories. It works with a single file like a Category 1 database, yet it handles different types of data like a Category 2 database. It doesn't have a procedural language like a Category 3 database, but it will "memorize" a set of commands so that you can create customized applications. And it has enough special features to put it in the running for the exclusive Category 4.

What is it, then? The program designers at DayFlo, Inc., call it a "free-form" database. They've tried to give it the flexibility of paper forms, together with the speed of computer processing. And to a remarkable extent, they've succeeded. *DayFlo* can perform some fancy tricks that more conventional database software couldn't even attempt. Does one customer record need space for a Telex number? With a few keystrokes you can add the Telex number to that one record without restructuring your entire database. Do you want to remind yourself that a certain supplier is habitually late? Just add a note to the vendor record where you can see it the next time you want to place an order. Not only that, *DayFlo* lets you store multiple values in the same field. So if you want to enter several phone numbers for a customer, just type them in.

This kind of flexibility means that you can give your data as much or as little structure as you like. You can create records with fixed-length fields like those you see in conventional databases, or "unlimited" fields of up to 32,000 bytes (about 20 double-spaced, typewritten pages). In order to help you enter this free-form data, *DayFlo* boasts a fairly sophisticated text editor, which, while it won't seriously challenge a standalone word processing program, is quite adequate for data

entry as well as for composing short letters and memos.

Still, while *Dayflo* can solve some pressing data management problems, it's not for everyone. Don't expect *DayFlo* to be an easy-to-learn product that you'll feel comfortable with after only short acquaintance. *DayFlo* is powerful and complex, and if you want to master it, you should plan on devoting many hours to study and practice. Even when you've learned it, it's not very easy to use. It has a hierarchical menu structure that requires multiple keystrokes to do just about everything. For instance, it takes five keystrokes to save the contents of your current work area to disk and resume working. To move a record from one work area to another takes seven keystrokes.

DayFlo also has a lot of commands that perform similar functions, and it's hard to keep them all straight. For retrieving records there's a GET and a RETRIEVE command, as well as a SEARCH function that looks for character strings. For deleting text you can use the Del key or a BLANK DELETE or CUT command. It takes a lot of practice to learn when to use which command.

When you do become proficient, there is no "expert" mode that allows you to bypass the menus. The closest thing is *DayFlo*'s ability to create macros that allow you to assign a sequence of commands to a single keystroke. This ability alleviates the problem to some extent, but I would have preferred a more economical native command structure.

Moreover, *DayFlo* is not a standalone program. If you want to print anything more complicated than a single record, you'll have to fork over an additional $195 for *ReportFlo*, *DayFlo*'s report-writing module. And *ReportFlo* is no speed demon. *DayFlo*'s data management speed is acceptable if you have enough RAM (I tested the product on an XT with 512K and found that it performed record storage and retrieval almost instantaneously). However, if you want to massage your data into a report, you can settle down for a good long wait: *ReportFlo* took more than 14 minutes to create *PC Magazine*'s standard report on the data in 500 personnel records. This compares with a time of 1 minute, 17 seconds for industry leader *dBASE II*.

And finally, because *DayFlo* is a word-oriented database, it doesn't excel in the number-crunching department. You can't use it to create an accounting system or manage point-of-sale inventory control. Nor does it make any provision for data security, such as passwords and encryption. Still, if you want relief from the rigidity of more traditional database software, *DayFlo* is worth considering.

Heavyweight

The *DayFlo/ReportFlo* package lets you know right away that this program wants to be a heavyweight contender in the database championship fights. In fact, it wouldn't hurt to do some weight training of your own before you try to take *DayFlo/ReportFlo* out of the store. The package includes two comprehensive loose-leaf reference guides and two thick tutorial guidebooks. You also get a function key

Name of Database:
DayFlo, Version 1.1
ReportFlo, Version 1.1
2500 Michelson Drive, Bldg. 400
Irvine, CA 92715
(714) 476-3044
DayFlo, $495; *ReportFlo*, $195.

Category:
2

SYSTEM SPECIFICATIONS

Maximum number of record types (relations or files) per database:
65,000

Maximum number of fields (attributes or data items) per record:
Limited only by maximum record size, only 100 index fields

Maximum record size:
32,000 bytes

Maximum number of records per file:
65,000

Maximum number of records per database:
65,000

Maximum field size:
32,000 bytes

PERFORMANCE MEASUREMENTS

Task 1. Time to enter standard data, either by importing or typing:
40 minutes

Task 2. Time to extract a random record:
30-second setup, instantaneous retrieval

Task 3. Time to prepare standard task:
2 minutes

Task 4: Time to execute standard task:
Instantaneous

Size of database created:
78,459 bytes

Space compression used?
No

Variable length of fields supported?
Yes

Number and size of ancillary files:
None

Degradation with additional indexes:
No

Task 5. Time to perform sort:
4 minutes, 25 seconds

Task 6. Time to create a standard report:
10 minutes

Task 7. Time to execute a standard report:
14 minutes, 20 seconds

Minimum hardware/software required:
IBM XT or PC with 10-megabyte hard disk, 320K RAM, floppy disk drive.

Suggested hardware/software configuration:
IBM XT or PC with 10-megabyte hard disk, 512K RAM, floppy disk drive.

Configurations used in testing:
IBM XT or PC with 10-megabyte hard disk, 512K RAM, floppy disk drive.

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template, a cardboard reference card, several booklets that give you a quick overview of the two programs, and some ready-made "Fast Track" solutions that show you how to put *DayFlo* to work.

The sheer volume of reference materials and instructions is intimidating but necessary for a program this complex. You'll often find yourself turning to the reference guides, which are organized by command and well indexed. The program also provides a context-sensitive help function for the times you're stuck. The tutorials are thorough, with lots of examples. However, the best part of the documentation consists of the *Fast Track* booklets, which come complete with sample files. One booklet shows you how to use *DayFlo* to organize your correspondence and produce form letters. Another illustrates how to manage contacts—that is, keep notes on all your sales or business contacts. An especially helpful booklet shows you how to create your own database, using some of the elements of the *Fast Track* solutions as models.

The first *Fast Track* booklet takes you through program installation, which is fast and painless. You just type in a few commands, and *DayFlo* essentially installs itself, along with some sample databases, onto your hard disk.

Each *DayFlo* database is a mammoth disk file (100K is the minimum size, and at

The DayFlo/ReportFlo package lets you know right away that it wants to be a heavy weight contender in the database championship fights.

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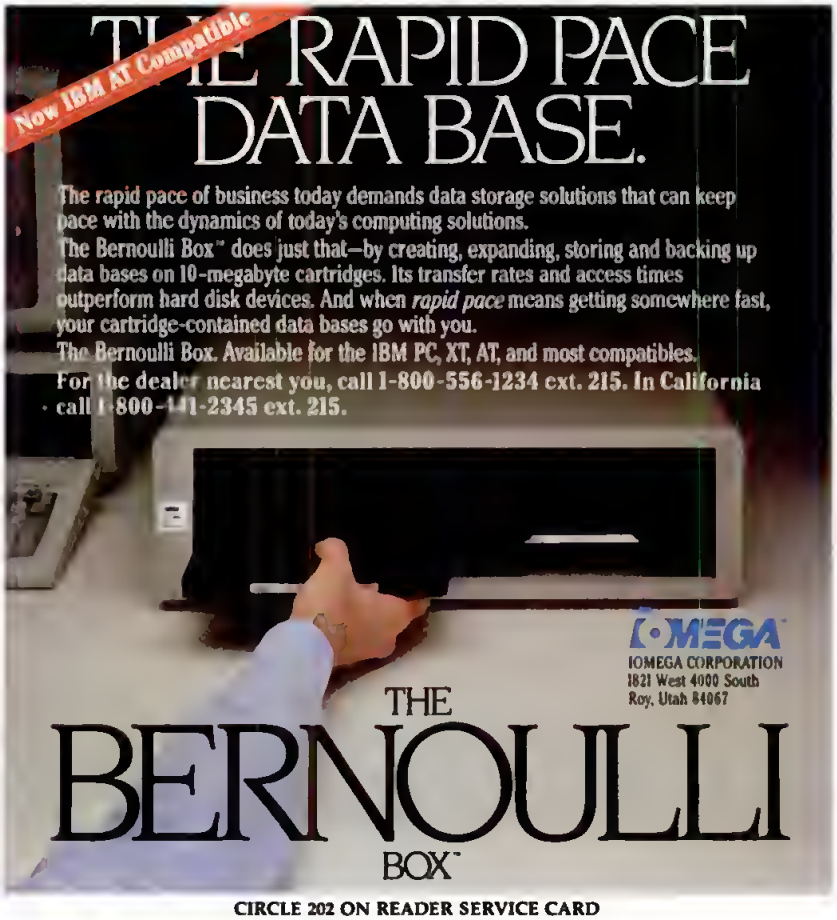

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least 500K is recommended) that acts as a self-contained work area. Since each record in *DayFlo* can be different, you could, in theory, store all of your information in a single database. In practice, however, if you work with thousands of records, you may want to divide them among several databases so that you don't exceed *DayFlo*'s data storage limits.

DayFlo has a utility menu that takes you through the steps of creating a new database file. The process is very simple

Installation is fast and painless. You just type in a few commands and DayFlo essentially installs itself, along with sample databases, onto your hard disk.

because you don't have to define how the data will look. You can do that later as you begin to work with your data. You need only give the database a DOS filename and tell *DayFlo* how much room to reserve for the file. *DayFlo* does all the rest, setting aside about 30K of the file for the necessary pointers, internal storage, and the data dictionary.

If you're a *PFS: FILE* or *dBASE II* user, DayFlo will send you a conversion program that will move your old data to your new *DayFlo* database. As of this writing, the company offered no general-purpose conversion program to move regular ASCII data into the *DayFlo* format, but Ken Hertzler of DayFlo, assured me that such a program was in the works. So, if you currently use a different database program, you'll want to check on the availability of this new conversion program before you buy. I used the *DayFlo*

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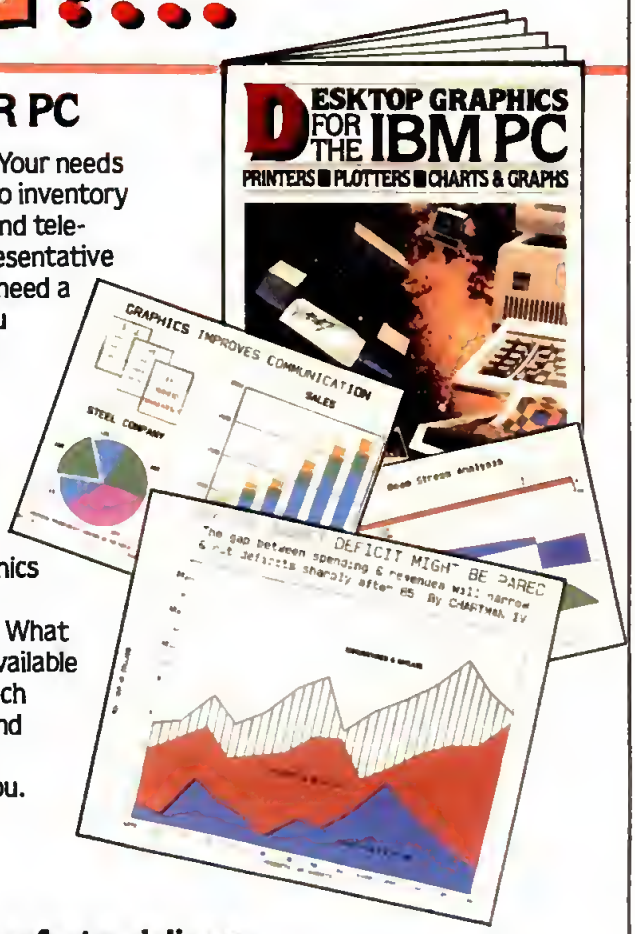

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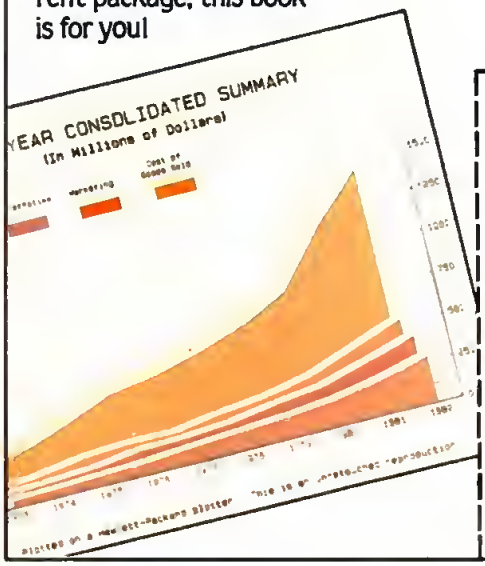

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conversion program to transfer a 500-record *dBASE II* database to *DayFlo*, and it worked without a hitch, albeit somewhat slowly.

Record Stacks

DayFlo, like some of the popular integrated software packages on the market, uses the metaphor of a desktop to help you understand its structure. But instead of using windows to represent different work spaces, *DayFlo* provides a set of 20 "stacks" of records on your metaphorical desktop, along with some desk accessories and office furniture as well. These include a trashcan, a "cutout holder," a filing cabinet, and a printer.

DayFlo's "work area" commands move records around just as you might move paper in your office, only faster. The file cabinet holds the bulk of your records most of the time. When you want to look at or work with your stored information, you pull one or more records out of the file and place them on top of a stack. Note that while your entire database can have up to 65,000 records, your desktop, including "stacks" and trash, is limited to 2,500 records. That means you can sort,

DayFlo, like some popular integrated software packages, uses the metaphor of a desktop to help you understand its structure.

print, or otherwise manipulate only 2,500 records at a time.

The concept of "stacks" is the key to understanding *DayFlo*. Whenever you're working with *DayFlo*, you're working with a stack. Most of the time, what you

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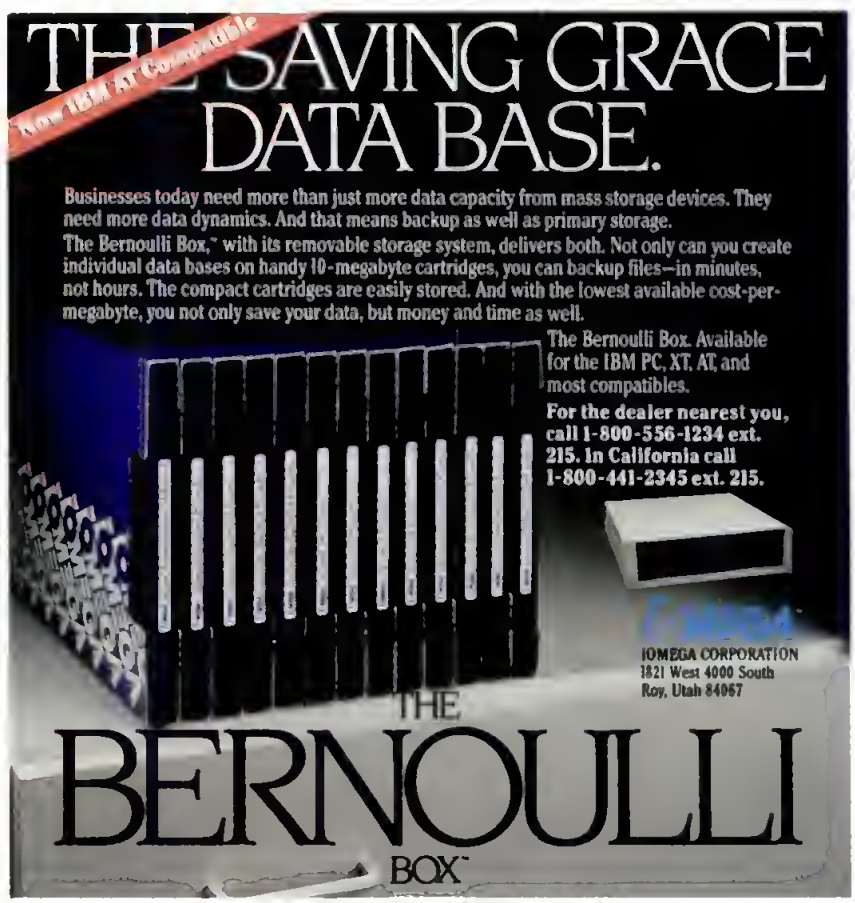

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see on your screen is the top records of your current stack. Using *DayFlo*'s text editor, you can add, delete, or modify information in the record much as you would if you were editing text with a word processing program. You can leaf through the records on your current stack, using the F10 key to take you to the next record and the F9 key to take you back to the previous record. You can also set your current stack aside, making one of the side stacks into your current stack. Each stack can have a name, like Memos, Addresses, or To Do List. Like the stacks of paper on your desk, *DayFlo* stacks can contain any kind of record you want. But you'd be better organized if you group similar kinds of information in the same stack.

The "file cabinet" is *DayFlo*'s all-purpose storage drawer. When you're finished working with a set of records, you can move them to the file cabinet, where they will stay out of sight until you need them again. The "trashcan," like a real wastebasket, holds records you no longer want. You can even rummage through the trash to see if you've thrown something away by mistake—unless you emptied the wastebasket via the program's CLEAN UP command.

But once you file something or toss it into the trash, how can you get it back? How does all of this free-form information get organized? The key is *DayFlo*'s data dictionary, which keeps track of the structured part of your database.

> The concept of "stacks" is the key to understanding DayFlo. Whenever you work with DayFlo, you work with a stack.

To use the data dictionary, go to *DayFlo*'s utility menu by pressing Alt-F2 and follow the prompts that let you add a definition. This process is a lot like creating a field in a traditional database program, except that you can add a definition whenever you want, not just when you define a new database. You specify parameters like the type of data the item should contain (text, number, date, or yes/no), maximum length of the item, and whether the item name should be indexed for fast retrieval. *DayFlo* can have an unlimited number of item names in the dictionary, but only 100 can be indexed, and a single record is limited to 32 indexed values.

If you want to create a structured database similar to the kind you'd see with a traditional database manager, you must define all of your field names, or, as *DayFlo* calls them, item names, in the data dictionary. For instance, to create a customer address list, you first define item names for Customer Name, Address, City, State, ZIP, and Telephone. Then you go to a stack on *DayFlo*'s metaphorical desktop and create a record. At that point you will face a blank window that represents *DayFlo*'s "scratch pad" or empty record.

Like a blank sheet of paper, this scratch pad will accept anything you care to type. However, since in this case you want to create a structured address record, press Ctrl-N to activate "item name mode" before you begin typing. The word "NAME" will appear on the status line at the bottom of the screen to remind you that this mode is active.

Look It Up

This mode opens communications between your record and the data dictionary. Suppose you now type "telephone" and then press Ctrl-N to turn off the item name mode. It's as if you telegraphed the word "telephone" to the data dictionary for a quick reference check. *DayFlo* will now interpret the next segment of text as the "item value." Depending on how you have defined the item in the dictionary, the item value can be free-form text or highly structured data like a telephone number or ZIP code. And *DayFlo* will make sure that you've entered the right kind of data. For instance, if you've specified that the item "telephone" can contain only numbers, *DayFlo* will beep at you if you try to type in letters.

> Like a blank sheet of paper, the "scratch pad" or empty record will accept anything you care to type.

Using the data dictionary, you can also specify "patterns" for your data. For instance, you could require that the value of an item called Social Security Number be in the familiar 000-00-0000 format.

This is the kind of error checking that you'd expect from a structured database program, but it's unusual in a program that also stores free-form data. *DayFlo* also gives you the freedom to decide whether or not to define new item names in the data dictionary. You'll probably want to make a habit of recording your definitions so that you can keep your database organized, but the decision is up to you. *DayFlo* will use item names, whether or not they're in the dictionary, for record retrieval and data manipulation such as sorting or preparing reports. But lest all this freedom degenerate into irremediable chaos, *DayFlo* sensibly requires that each record have at least one indexed item before you can store it.

Indexed items must appear in the data dictionary, and when *DayFlo* is searching for an indexed item, it can retrieve it almost instantly. When it searches for a nonindexed item, you can expect the search to last several minutes, since *DayFlo* goes through each record in your database.

This ability to manage free-form data is *DayFlo*'s greatest strength. However,

DayFlo also contains the seeds of possible future greatness in its "command logs." In the current version, *DayFlo*'s command logs are almost identical in function to macros, except that they're more difficult to use.

DayFlo's macro facility is called *MacroKey* and looks strikingly similar to *SmartKey II Plus*, the standalone macro processor program from Software Research Technologies. When I asked about this similarity, Hertzler said that *SmartKey*'s authors wrote *MacroKey* to fit *DayFlo*'s specifications, so the similarity is not accidental. *MacroKey* allows you to assign blocks of text or commands to a single keystroke and includes other useful macro options, such as fill-in-the-blank macros and macros that call other macros. To create a macro, simply press Ctrl-F5, type the key you wish to redefine, and type in your macro. To signal the end of the macro, type Ctrl-F5 again and press Q for quit. *DayFlo* comes with a set of handy *MacroKey* macros that streamline *DayFlo* considerably.

MacroKey allows you to assign blocks of text or commands to a single keystroke and includes other useful macro options.

The command logs are considerably more cumbersome. To create a command log, you have to use several keystrokes to get to the log menu, where you tell *DayFlo* to begin recording. *DayFlo* will then "memorize" your subsequent keystrokes until you tell it to stop recording. When you finish recording a log, you give the log a name that you can later use to invoke it from the log menu.

In this form, it's not very easy to create or use a command log. And if you want to change a log, you have to record it all over again from scratch. However, Hertzler told me that future releases will allow you to edit the logs and insert many of the elements of a procedural language. Once this

CIRCLE 109 ON READER SERVICE CARD

facility is available, people will be able to develop sophisticated, customized applications using *DayFlo*. However, given the present state of the command log facility, I don't know why anyone would want to use a command log rather than a *MacroKey* macro.

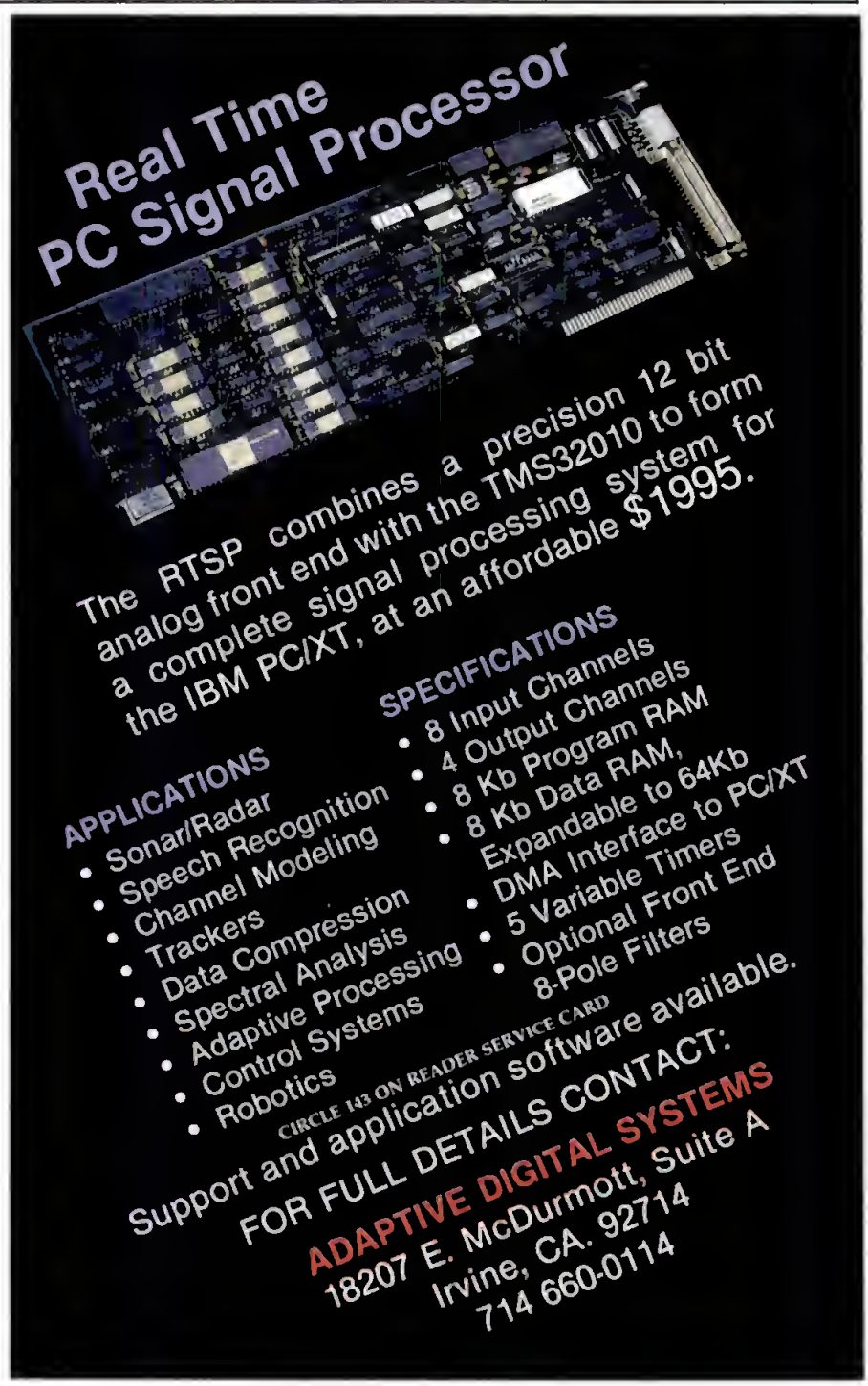
Weaknesses

DayFlo shows its weak side when it tries its hand at the routine tasks of managing structured data. If you want to do repetitive data entry, you can create a blank form analogous to a blank preprinted paper form in which only the item names appear. Then you can fill in these blanks on screen.

Many structured database managers give you all the tools you need to begin entering structured data once you've created your database. However, it's a bit of a chore to get *DayFlo* to manage structured data, since first you have to retrieve a blank form, duplicate it, and then send the form back to the file before you begin the business of data entry. You can automate this process by using a *DayFlo* macro or a *DayFlo* command log, and the *DayFlo Fast Track* booklets show you how it's done. Still, plan on devoting quite a bit of setup time before you can do repetitive data entry by using only a few simplified commands.

> DayFlo is weak in word processing abilities. If you're used to a full-featured word processor, you'll be disappointed.

DayFlo is also weak in its word processing abilities. If you're used to a full-featured word processor, you'll be disappointed with *DayFlo*. While the basics of the "what you see is what you get" school of word processing—such as full-screen editing, word wrap, paragraph reformatting, search and replace, and cut and paste—are here, other niceties are missing. You won't get automatic centering, temporary margins, single-stroke word delete, horizontal scrolling, or embedded



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printer control codes for producing special effects.

The cut-and-paste function is limited to 5,000 bytes per text move, so I couldn't move or delete large blocks of text at a time. I was also irritated by *DayFlo*'s paragraph-reformatting function, which recognizes paragraphs only if they are preceded and followed by a blank line. Until I caught on to this distinction, I unwittingly reformatted my entire text into a single paragraph. Speed, or rather the lack thereof, was another annoyance. The screen display lagged slightly when I let loose with a quick burst of touch typing. The paragraph-reformatting command also exhibited a noticeable delay.

The DayFlo editor has a very powerful "undo" command that lets you reverse almost every change you make.

On the bright side, the *DayFlo* editor has a very powerful "undo" command that lets you reverse almost every change you make to your record. In addition, *ReportFlo* provides a comprehensive set of printing options so that you can create headers, footers, page numbers, subtotals, and totals to your heart's content. Like *DayFlo*, *ReportFlo* has a complex menu structure that takes time to learn, but it has some powerful talents. It works with records in a single *DayFlo* stack, so it can manipulate up to 2,500 records at a time. It can mix text, such as memos and letters, together with the more conventional columnar reports that you get with traditional database managers.

About now, you may be asking yourself the $690 question. Do you want to organize your day around *DayFlo* and *ReportFlo*? If more traditional database managers have hemmed you in—if you need a word-oriented database with a great deal of flexibility—the answer may be yes. But if you don't really need *DayFlo*'s flexibility, you would probably be better served by a traditional database manager with a simpler command structure. ■

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CIRCLE 360 ON READER SERVICE CARD

The Great Printer Swap

These LPTPORT programs let you switch between high-speed draft and letter quality printers.

1985/No. 5

Attaching two printers to your PC can be a useful thing to do. Having two allows you to take advantage of the high speed of a matrix printer for drafts while continuing to produce final copies using a slower daisywheel printer. It's also easy to do—just slip a second parallel port, either IBM's or one that's included with a third-party multifunction board, into an expansion slot and hook a cable from the port to a second printer.

You're likely to have some problems, though, when you go to use the second printer. Some software packages recognize the PC's ability to support more than one printer (as many as three can be attached), but many do not.

Among the more popular programs that don't recognize the second printer is PC-DOS itself. There is, for example, no way to redirect the output of a simple Shift-PrtSc to a second printer. Reading the documentation for the MODE command could make you *think* DOS can switch the first printer (LPT1:) with the second (LPT2:). Indeed, it will even accept

```
A>mode lpt1:=lpt2:
```

but it doesn't do the job! You can use PC-DOS I/O redirection to send screen output of some programs to an alternate printer, but there's no way to change the destination of regular printed output.

It's a problem, however, that is easy

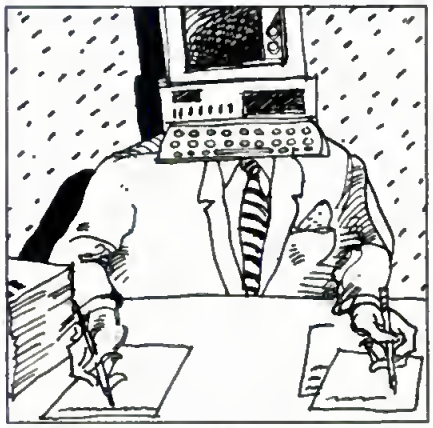

Illustration: Yvonne Buchanan

and even fun to fix. All you have to do is convince the PC's Basic Input Output System (BIOS) that LPT1: is LPT2: and vice versa. That isn't as difficult as it sounds because the BIOS programs store information that identifies attached devices in an area of low memory called the ROM BIOS Data Area.

In the case of printer ports, the BIOS stores the input/output addresses of the attached printers in a four-word array called PRINTER_BASE. I/O addresses, or ports, are similar to RAM memory addresses, but locate places in a separate area of the PC called the I/O Address Space. Each word in the PRINTER_BASE array contains an I/O port

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address associated with a printer port, starting with the first (LPT1:) and ending with the third (LPT3:). There is space reserved in the array for four printer ports, although the PC's specifications allow for only three.

If you write a program that simply switches the I/O address for LPT1: with that for LPT2:, most programs will print on LPT2: instead of LPT1: without any further ado. There are several approaches to switching the printer ports around, and this task is a good example of the number of different ways you can do almost anything on the PC.

I'll start by presenting a simple BASIC program that switches the printer ports around, then move on to an assembly language program that does the same thing. The .COM program produced by the Assembler is faster and more convenient to use than the BASIC program. The .COM program is so small that it's reasonable to enter it using the DEBUG assembler, and I'll show you how to do that as well as how to use the Macro (or Small) Assembler to create it. As usual, I've also included a BASIC program designed to create the .COM file program for you.

BASIC Version of LPTPORT

The BASIC program is the simplest one of all and will give you a good feel for how the low memory BIOS data is arranged and used, so it's a good place to start. Figure 1 shows the BASIC program (LPTPORT.BAS) in its simplest form. The program defines the current data segment at location 40H, or at absolute memory address 400H. This is where the ROM BIOS Data Area is located and, if you get out your hexadecimal calculator and look at the ROM BIOS listing in the *Technical Reference* manual, you'll find that this is the first byte after the 1,024 bytes reserved for the PC's interrupt vectors.

After defining the data segment, LPTPORT.BAS PEEKs at memory addresses 8 and 9 to find the I/O address for LPT1: and at memory addresses 10 and 11 for LPT2:'s I/O address. The actual port switching is done by POKEing the I/O address for LPT2: into the memory locations reserved for LPT1: and vice versa.

LPTPORT.BAS contains no PRINT statements to tell you what's going on, but you can add them yourself if you want to follow the port-swapping process along. Remember that words are stored in the PC's memory low byte first, high byte second. If you want to print the values of the original printer port addresses, the following statements will do the job:

```
225 PRINT "Original Port
    Location for LPT1: is";
    HEX$(PRINTER.BASE.0(1))+
    HEX$(PRINTER.BASE.0(0))
226 PRINT "Original Port
    Location for LPT2: is ";
    HEX$(PRINTER.BASE.2(1))+
    HEX$(PRINTER.BASE 2(0))
```

```
100 ' BASIC program to switch LPT1: with LPT2:
110 ' (C) 1984, Dickinson Associates Inc.
120 '
130 ' Define Data Segment as ROM BIOS DATA AREA
140 '
150 DEF SEG=&H40
160 '
170 ' Read Printer Port Addresses into PRINTER.BASE Arrays
180 '
190 PRINTER.BASE.0(0) = PEEK(8)
200 PRINTER.BASE.0(1) = PEEK(9)
210 PRINTER.BASE.2(0) = PEEK(10)
220 PRINTER.BASE.2(1) = PEEK(11)
230 '
240 ' Write Printer Port Addresses in Reverse Order
250 '
260 POKE 8, PRINTER.BASE.2(0)
270 POKE 9, PRINTER.BASE.2(1)
280 POKE 10, PRINTER.BASE.0(0)
290 POKE 11, PRINTER.BASE.0(1)
300 '
310 SYSTEM       ' Optional for use in:  BASIC LPTPORT
```

Figure 1: *The LPTPORT.BAS program shown here switches port addresses, permitting alternate use of draft- and letter-quality printers.*

```
A>debug
-d 40:8
0040:0000                                BC 03 78 02 00 00 00 00        <.x.....
0040:0010  33 82 F0 00 02 00 00 00-00 00 36 00 38 00 74 14   3.p.......6.8.t.
0040:0020  2E 34 63 2E 6F 18 6D 32-0D 1C 64 20 20 39 34 05   .4c.o.m2..d  94.
0040:0030  30 0B 3A 27 38 09 0D 1C-70 19 6F 18 72 13 00 00   0.:'8...p.o.r...
0040:0040  B5 00 4B 01 09 91 00 A0-20 07 50 00 00 40 00 00   5.K....  .P..@..
0040:0050  00 08 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0040:0060  0C 0B 00 B4 03 29 20 B3-02 3F 08 00 1A DC 0A 00   ...4.) 3.?...\..
0040:0070  00 00 00 12 00 01 00 00-14 14 14 14 01 01 01 01   ................
0040:0080  1E 00 3E 00 00 00 00 00                           ..>.....
```

Figure 2: *A hex dump, using DEBUG, shows the first 4 bytes of printer port data at memory locations 8 through 11.*

```
title   LPTPORT.ASM - Switch Printer Ports Between LPT1: and LPT2:
;
; (C) Copyright 1984, Dickinson Associates Inc.
;
ROM_BIOS_DATA   segment at 40h          ; Low Memory "BIOS" Parameters at 40H
        org     8h                      ; Printer port addresses are at byte 8
        PRINTER_BASE    dw  4 dup(?)    ; Four words for Printer Port
                                        ; I/O Address Locations
ROM_BIOS_DATA   ends                    ; End of data segment
;
CODE_SEG    segment para 'code'
;
        assume  ds:ROM_BIOS_DATA, cs:CODE_SEG, ss:NOTHING, es:NOTHING
        org     100h                    ; .COM format program
;
BEGIN:
        mov     ax,ROM_BIOS_DATA        ; Make ROM_BIOS_DATA addressable
        mov     ds,ax                   ; via DS register.
;
        mov     ax,PRINTER_BASE[0]      ; Move LPT1: port address to AX
        mov     bx,PRINTER_BASE[2]      ; Move LPT2: port address to BX
        mov     PRINTER_BASE[0],bx      ; Switch the port addresses around
        mov     PRINTER_BASE[2],ax      ; by moving them back in reverse order.
;
        ret                             ; Back to PC-DOS
;
CODE_SEG        ends                    ; End of code segment
;
        end     BEGIN                   ; End of program
```

Figure 3: *Here is an assembly language program to switch your printer ports.*

One optional statement is the SYSTEM command on line 310 of the program. If you use the program by starting BASIC and running it, the statement is not necessary. But if you want to execute LPTPORT.BAS by typing

```
A>basic lptport
```

directly from PC-DOS, the SYSTEM command is a great convenience.

Checking It Out with DEBUG

How is it possible to check on LPTPORT.BAS's operation without putting a lot of PRINT statements in it? It's easy to use the PC-DOS DEBUG program to find out how the program worked. Figure 2 shows you all you have to do to start DEBUG from the PC-DOS prompt and display the proper memory locations (8 through 11) in the data segment starting at 40H. The commands you type in are printed in lower case.

The data displayed about halfway across the first line of the dump contains the 4 bytes of printer port data as they will appear if you have two printer ports but have not yet switched them using LPTPORT.BAS. As you look at the data, remember, once again, that the PC stores words with the low byte first and the high byte second.

If you leave DEBUG and run LPTPORT.BAS, that same line will contain the values

```
7B 02 BC 03
```

in the same locations.

Assembling LPTPORT

The process of switching printer ports is equally simple in assembly language. The data segment and variable names used in LPTPORT.ASM (see Figure 3) are exactly those used in the original ROM BIOS code found in the IBM *Technical Reference* manual (PC, XT, and AT editions). This will help clarify your understanding of the program and its relationship to the BIOS data area and also will explain why such odd-sounding names were used in the BASIC version of LPTPORT.

ROM_BIOS_DATA is located absolutely at segment 40H through the use of the AT combine-type directive in the segment pseudo-op. The PRINTER_BASE array is located correctly with an ORG pseudo-op that starts it at offset (byte) 8 in the segment. There is no need to jump (JMP) around the data segment in this program because it's located absolutely, and the assembler knows not to place it within

the executable code of the program.

LPTPORT.ASM's first job is to establish the addressability of the ROM_BIOS_DATA segment and then proceeds to swap the port addresses around. The address for LPT1:, stored in PRINTER_BASE [0], is moved into the AX register, and the address for LPT2:, in PRINTER_BASE [2], is moved into the BX register. The swap occurs when they are moved back to PRINTER_BASE array in reverse order.

To make the program operational, simply assemble it (MASM or ASM will do fine), link edit it using LINK, and then convert it to a .COM file format using EXE2BIN. The procedure (and program) works fine on any version of PC-DOS.

```
A>debug
-a
1EFF:0100   mov ax,0040
1EFF:0103   mov ds,ax
1EFF:0105   mov ax,[0008]
1EFF:0108   mov bx,[000a]
1EFF:010C   mov [0008],bx
1EFF:0110   mov [000a],ax
1EFF:0113   ret
1EFF:0114
-n lptport.com
-r cx
CX 0000
:14
-w
Writing 0014 bytes
-q

A>
```

Figure 4: *The DEBUG assembler can alternatively be used to create LPTPORT.COM.*

Saving Disk Real Estate

LPTPORT works identically to the LPTPORT.BAS in substance, but not in form—LPTPORT.BAS occupies 616 bytes of disk space while LPTPOR.COM takes up only 20 bytes. And that doesn't count the 20K or so bytes you need for BASIC.COM to run it. Disk space may be a consideration for you, especially if you don't have a Winchester disk and are tight for space on your word processing or other applications diskettes. If you don't have access to the IBM Macro Assembler, you might think you're stuck using BASIC.

Don't worry—this is one case where you're definitely not out of luck. If you have PC-DOS Version 2.0 or higher, LPTPORT.COM can easily be entered using the DEBUG Assembler. Figure 4 contains a DEBUG session that will show you everything you have to do. Just make sure your PC-DOS Extensions disk (hopefully a copy of it) is in the default drive, and type DEBUG. (You can enter everything in lower case.)

Once in DEBUG, type A (for Assemble) and enter the assembly language mnemonics (commands) as you see them in Figure 4. When you're done, enter a second successive carriage return. Then load the CX register using the R CX command (at the prompt enter a 14, which is decimal 20 in hex). Name the program with the N command (it doesn't have to be on the default drive but must have a filename

```
100 ' PORTS - BASIC Program to Create LPTPORT.COM
110 ' Copyright 1984, Dickinson Associates Inc.
120 '
130 GRAND.TOTAL.# = 0
140 OPEN "LPTPORT.COM" AS #1 LEN=1
150 FIELD #1, 1 AS PORTS.BYTE.$
160 FOR I.% = 1 TO 20
170     READ PORTS.DATA.%
180     GRAND.TOTAL.# = GRAND.TOTAL.# + PORTS.DATA.%
190     LSET PORTS.BYTE.$ = CHR$(PORTS.DATA.%)
200     PUT #1
210     PRINT USING "########"; GRAND.TOTAL.#;
220 NEXT I.%
230 READ THE.TOTAL.#
240 IF THE.TOTAL.# <> GRAND.TOTAL.# THEN PRINT CHR$(7):
      PRINT "***Error - Total Incorrect!" :
      PRINT "***Check Data Statements and Re-run the program."
250 CLOSE #1
260 END
270 DATA   184,    64,     0,   142,   216,   161,     8,     0,   139,    30
280 DATA    10,     0,   137,    30,     8,     0,   163,    10,     0,   195
290 DATA  1497
```

Figure 5: *This program shows how the printer switching LPTPORT.COM can be created directly from BASIC.*

extension of .COM), then write the file using the W command.

If you're not comfortable using DEBUG but want the .COM version of LPTPORT anyway, there is one last resort, shown in Figure 5. It contains a PORTS.BAS that will load the program into a file named LPTPORT.COM.

Spooler programs look at the printer port addresses only when they start.

If you have gone to the trouble of using the IBM assembler and use DEBUG to unassemble your program, you'll find yourself looking at the same code shown in Figure 4. And if you unassemble the results of PORTS.BAS, once again you'll be looking at the same code.

Internal print spoolers, such as the programs supplied by board manufacturers or user groups and bulletin boards, cause one small operating problem. After the spooler program has been loaded (you usually do this in your AUTOEXEC.BAT program), any version of LPTPORT will run correctly, but its work will be ignored! The reason is that the spooler programs look at the printer port addresses only when they start. Since they assume you'll never change them, they never look again and keep on using the original port address (usually for LPT1:).

To get your PC to switch printer ports when using an internal spooler, run your version of LPTPORT *before* the spooler is loaded. The I/O address for the LPT2: will then be in LPT1:'s spot and will be used correctly by the spooler.

If you're interested, you can develop a different version of LPTPORT that switches your COM1: and COM2: ports. They're located directly below PRINTER_BASE in another four-word array called RS232_BASE. Have fun! ■

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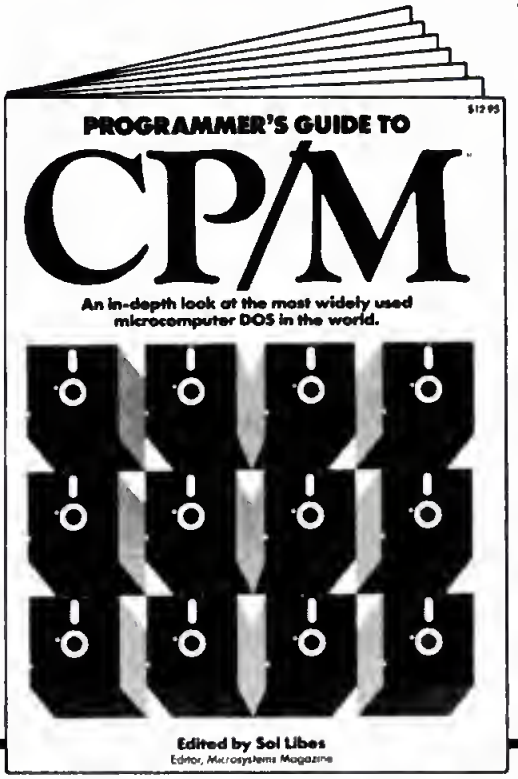

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Instant Wordplay

If you've ever scored in Scrabble with the word "vortex" on a "double-word square," you'll want to try two computer games that imitate the classics—Word Challenge and Monty Plays Scrabble.

Word games have fascinated inquisitive men and women ever since words were first invented. Their special appeal is that the games require a strategy based on a commanding knowledge of the language. In many ways, people can use word games to measure and test their knowledge. Scrabble and Boggle are prime examples of these popular games. Keeping in mind how players use such word games, do you think the medium of the computer enhances their excitement as well as your ability to play? To get a feel for how well these classic word games translate to the screen, take a look at *Word Challenge* and *Monty Plays Scrabble*.

A screen from *Word Challenge*, showing one of the many board configurations.

Word Challenge

Word Challenge is based on Boggle, the ingenious and simple game made by Parker Brothers. In this game, the players race to form as many words as possible within a grid of randomly selected letters. They form words by tracing paths through adjacent letters, orthogonally as well as diagonally, and in a combination of directions.

Boggle is a social game: as many players as will fit around a table can play. *Word Challenge*, however, pits just one player at a time against a computer opponent, called Lex.

Lex challenges you at 26 levels that handicap the computer's ability to search words within the grid by restricting the number and the length of words. On its easiest levels, for instance, Lex will not even bother looking for long or obscure words. Instead it will settle for words like *man*, *are*, and *toe*. But on the more difficult levels, Lex will find words like *emu*, *ilia*, *peplum*, and *veep*.

The program boots automatically to a title screen that allows you to select a color display if you have the proper equipment. Otherwise, it defaults to monochrome. You can play the game either way, but, not surprisingly, the color dis-

Word Challenge
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play is far more readable.

Next comes the menu. It's a carte-blanche affair that lets you serve yourself the exact game variation you want. You can change the difficulty level from A to Z; enter your own board arrangement of letters; use the same board repeatedly; select a 3-by-3, 4-by-4, or 5-by-5 grid; determine the winning score, up to 999 points; set the game timer, up to 999 seconds; and turn the sound on or off. There're so many possibilities for fine-tuning that you feel like you are in control of the game's design.

The 5-by-5 grid presents the most intriguing challenge to an adult, and no matter how great your vocabulary, I guarantee that you'll be surprised at the number and nature of the words you fail to "see" within it. To help you visualize words, the designers included a thoughtful detail: The F5 and F6 keys will rotate the grid 90 degrees in either direction. (Bless your kind hearts, whomever you are.)

The human player may begin by typing in his or her list of words as soon as the grid appears; those words appear in a box to the right. Meanwhile, Lex builds a list that is not displayed during the game, so you can't steal its words. The computer scorekeeper goes through its built-in 90,000-word dictionary to create a list of all possible words from the current grid.

Saving Space

The average word length in the game dictionary is eight letters, which means the dictionary should require about 800K bytes of disk space. But it doesn't. Because of a compression technique that stores only root words and codes all possible endings, the dictionary uses only 93K on the single game disk. Thus, to store the five words *bare*, *barer*, *barest*, *barely*, and *baring*, you must store only the first word along with codes for *r*, *st*, *ly*, and *ing* endings.

When time runs out, the scorekeeper compares your words and Lex's words with the list compiled from the dictionary. The box to the right of the grid displays each word along with which player or players found it. If both players find the same word, then neither earns points for it. Scoring can be based on one of five methods, including giving longer words, or more words, more points.

I admit I'm a good word-game player as well as a longtime Boggle aficianado. For that reason, I was surprised to find the most even challenge between me and Lex was at skill level K. However, that was a pleasant surprise because it meant I have a lot of room to grow within the game's boundaries. And just in case you are wondering whether the same board arrangements keep surfacing, relax. For each grid size, 3 by 3 to 5 by 5, there are 65,536 very different boards.

Because I enjoy this game very much, I would recommend it to anyone of any age or skill level. On *PC*'s scale of 1 to 6, *Word Challenge* rates:

FUN:	5.0
CHALLENGE:	6.0
SOUND/GRAPHICS:	4.5
TOTAL SCORE:	15.5

Monty Plays Scrabble
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Scrabble is another of my favorite board games, but because I am a writer and a game expert, my wife and friends won't play with me anymore. That's why I was very excited when I met Monty. He is always free for a game, doesn't get tired, can't spill his drink on the board, and never cheats. "Monty" is your antagonist in the computer program *Monty Plays Scrabble*.

Monty Plays Scrabble boots automatically to the combination playing board/menu screen, and Monty asks for the number of human players (one to three), their names, and the order in which everyone will play. Then the tiles of the first player are displayed, and he or she may type in a word, free of a time limit. By now, you must have anticipated my first major criticism.

It's not the lack of a time limit that bothers me because if you play alone against Monty, you can impose your own. And if you play a social game, democracy will take care of things. The real problem is that, in a social game, players' tile racks are displayed on the screen for anyone to see. So the only time you can look at the screen, which contains both the board and tile rack you so desperately need to study, is during your turn. When other players are up, you must physically shield your eyes from the monitor. Naturally this doesn't work.

Scrabble by Another Name

In spite of this restriction, when you play alone against Monty, you *are* playing the familiar game of Scrabble. And if you play at the higher-skill levels, you are playing a very formidable opponent, which can come up with two-letter plays that net more than 20 points. In fact, most of my three dozen or so games against Monty have been humbling experiences. So humbling, in fact, that I wanted to cheat. And cheating turns out to be as easy as telling Monty that *jexykaz* is a word. Monty is a sucker.

On the other hand, Monty's 44,000-word memory comes from the *Official Scrabble Player's Dictionary*, which is full of unlikely words like *wud* and *dah*. You are allowed to challenge Monty's word, but you are supposed to look the word up in your dictionary and respond yes or no to its legality. Monty will also challenge some of your words but sometimes does so illogically.

One final complaint: Monty takes too much time figuring out the next move. In many situations, he will dawdle for up to a full minute.

I don't think the time factor would

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bother me as much if the game would leave my tile rack on screen during Monty's turn. And it's a pain to write my tile letters down on paper. So whenever I get antsy, I push the Escape key and force Monty's move. If the program doesn't have one in mind by that time, it simulates the actions of a "stumped" player and exchanges its tiles; then it's my turn to play.

If you are honest and patient, you may love *Monty Plays Scrabble*. But if you can't wait and like to cheat, like the rest of us, then you'll probably rate *Monty Plays Scrabble* on *PC*'s scale of 1 to 6 as I did:

FUN:	2.0
CHALLENGE:	5.0
SOUND/GRAPHICS:	4.5
TOTAL SCORE:	11.5

■

A screen from *Monty Plays Scrabble*, showing a partly filled board.

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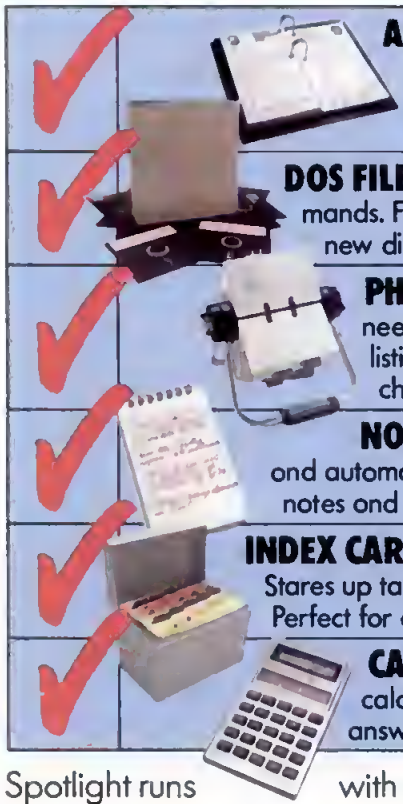

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MARK ZACHMANN

PC Tutor

Peering at a Pincushion

Q: *I am having a problem using a Quadram Quadcolor I color adapter with a Princeton Graphics Systems HX-12 monitor. Although the overall quality of the monitor is quite good, its display area is*

not rectangular. Both sides of the screen get pulled in at the middle, resulting in a concave shape on each side. This distortion is most evident when I paint the border or if I have a full screen of text.

I have heard speculations that there are different band widths on the color adapter and the color monitor. I have, however, seen other HX-12 monitors that are able to perform normally with different kinds of adapters.

I don't feel comfortable looking at a deformed screen. Any suggestions?

Raymond Ho
San Bruno, California

A: The problem you describe is generally caused by misalignment of the monitor. It's sometimes called the "pincushion effect" because the monitor screen looks a bit like a bulging pincushion.

You might be able to decrease the distortion by lowering the intensity of the monitor. I suggest, however, that you have a technician look at your monitor and the display adapter, since you really do have a hardware problem.

IBM's Missing Italic

Q: *I tried using the Lotus* 1-2-3 *print macros for producing italics on an Epson/IBM dot-matrix printer that were published in User-to-User (see* PC, *Volume 3 Number 17, page 391). These worked on the Epson FX-100 printer in my office but did not work on my IBM 5152 Dot Matrix Graphics Printer at home.*

I called Epson in California and was told that, although Epson manufactures the "chassis" of IBM's printer, the ROM chips are IBM's own and are not identical to the ones in an Epson-brand printer. Epson's representative did not know how to produce italics on the IBM. Unfortunately, IBM does not supply information about its printing codes and did not return my telephone calls for information.

I'd appreciate it if you can tell me how to produce italics on my IBM printer.

Martin B. Cowan
New York, New York

A: The primary difference between the IBM Graphics Printer and Epson MX-80 with Graftrax lies in their extended character sets. (Your Epson FX-series printer is a considerably enhanced version of the MX/IBM series that contains many additional control codes.)

The FX and MX printers, as delivered by Epson, have an alternate character set of italics. IBM's alternate character set, however, is designed to correspond to the additional 128 characters available on the IBM's display. These include foreign language characters, mathematical symbols, Greek letters, and line-drawing characters.

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CIRCLE 214 ON READER SERVICE CARD

PC TUTOR

your IBM printer, you probably got those special characters instead of italics. Because of the different character sets, there is no way to get italic text from the IBM printer, other than through dot-level graphics.

There is a way you can get a contrast similar to that between italic and regular text. You could print most of your output in enhanced or double-strike mode and then print the italicized portions in normal mode, which looks a bit lighter and less dense. You might find this acceptable. Another possibility is to use underlining as a means of emphasis.

These printer codes for the IBM Graphics Printer are as follows:

Escape G turns double strike on.
Escape H turns double strike off.
Escape E turns enhanced mode on.
Escape F turns enhanced mode off.
Escape −1 turns underlining on.
Escape −0 turns underlining off.

(Note that the last two sequences have three characters: the Escape, a dash, then a number.)

The *1-2-3* macros that will produce these effects were included in the item you saw in User-to-User. They should work on the IBM Graphics Printer, even though the italics codes didn't.

Direct Disk Writing

Q: *I have an IBM PC at home but use Apple IIe's at school. On the Apple computers, I use a routine called RWTS, which permits me to edit machine language programs and directory information. Is there any way I can do the same things on my IBM PC?*

I would like to be able to change a bit of data on a disk without opening a file to store it. I'd need a BASIC program that would read the specified sector on the disk into a specified memory location. Then I could change something, if necessary, and write it back to the same spot or any other spot on the disk I desired. Is this procedure possible?

Mike Eckert
Pardeeville, Wisconsin

A: Yes, you can do all those things on an IBM PC. My first suggestion is to investigate the DEBUG program that's provided with the PC, rather than working through BASIC. DEBUG has facilities for reading and writing sectors as well as files and has provisions for examining machine language programs.

DEBUG has facilities for reading and writing sectors as well as files and has provisions for examining machine language programs.

You can translate machine language into assembly code by using the Unassemble command (U) of DEBUG. The Assemble command (A) lets you enter assembly language code into memory, the Load command (L) lets you load sectors and files, and the Write command (W) lets you write sectors and files.

Here are some examples of using these commands.

To load a file into memory, use this pair of commands, beginning with a Name command (N):

```
NMYFILE     ; file name MYFILE
L           ; load file into
              memory
```

To load a sector into memory, you would use a command like one of these Load commands:

```
L100 0 0 20
  ; load sector 20(hex) from
    disk number 0 (A:) side 0
    into location 100

L200 2 1 10
  ; load sector 10(hex) from
    disk number 2 (C:) side 1
    into location 200
```

```
MOV   AH,2        ; read
MOV   AL,3        ; 3 sectors
MOV   CH,4        ; track #4
MOV   CL,1        ; start with sector 1
MOV   DL,2        ; drive #2 (C:)
MOV   DH,0        ; side 0
MOV   SI,2000
MOV   ES,SI
MOV   BX,200      ; address 2000:200
INT 13            ; disk interrupt 13
RETF              ; return far
```

Figure 1: *An assembly language routine that reads from a specific sector on the disk into a specific memory address.*

The Write command (W) is more or less the inverse of the Load command; it writes from memory onto the disk.

Using the Unassemble, Enter (E), and Dump (D) commands, you can display and edit a file or sector.

If you insist on using BASIC to modify a sector (a practice I strongly discourage), you will still need to include a small assembly language routine in your BASIC code. (See Figure 1.)

In the first line of Figure 1, I used command number 2, which means to read; by changing the value for AH to 3 here, you can write instead. Also, note that the value of ES (here it's 2,000) determines the first 4 digits of the address where the sector that was read will be put (or, if the Write command is in effect, it determines where to get the data that will be written to disk). This number is quite critical, because BASIC, DOS, and other files take up some space in memory that you should be extremely careful not to write on.

While you're using DEBUG, the Register command (R) will tell you the current values of the registers. I suggest you not change ES (the Extra Segment register); just leave it the way DEBUG sets it.

For additional information, see the IBM *Technical Reference* manual, which discusses disk interrupt 13 in gory detail. This manual includes commented source code for the interrupt routines, so you should find it an invaluable reference if you need to include assembly language code in your programs. Another excellent reference, which tells how to program the IBM PC's 8088 microprocessor chip, is *The 8086 Book* by Russell Rector and George Alexy, published by Osborne/McGraw-Hill in 1980.

You asked if a BASIC program could be used to accomplish this task. Yes, the way to do it is to enter the assembly language program through DEBUG's A command. Then use the D command to examine the disassembled program, which will appear as a series of paired hex numbers. Finally, arrange those numbers properly in the DATA statements of a BASIC program that will read the numbers into memory. There, the code is identical to the original assembly language program. Next issue, I'll explain in greater detail how to do such a conversion.

In the present case, however, I've had nothing but trouble when I've tried to run the assembly language routine in Figure 1 through a BASIC program. Either I've been doing something wrong, or it's true that BASIC really would prefer to handle all disk I/O itself.

The PC Tutor solves practical problems and explains points of general interest. If you'd like to see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. ■

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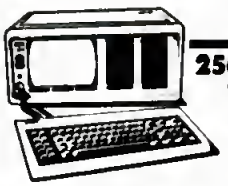

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CIRCLE 179 ON READER SERVICE CARD

EDITED BY PAUL SOMERSON

User-to-User

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Extra WordStar Keys

WordStar *has a built-in table for users to add ten redundant function key entries. If you find yourself constantly using multikeystroke commands that you'd like to put on function keys but are already using F1 through F10,* WordStar *will let you do it while retaining the original multikeystroke commands as well.*

I often find it necessary to dart from one end of a line to the other. You can do this now by hitting Ctrl-Q-S and Ctrl-Q-D, but each operation involves three keys. It's easy to use the installation program to put these onto function keys, but mine are already used for other commands. However, I almost never use the left and right brackets, so it seemed logical to make them into function keys to scoot the cursor back and forth across a line.

Make a copy of WS.COM, and use DEBUG to make the changes in Figure 1. Type in everything underlined, and hit the Enter key at the end of each line you type. The redundant entry table in Version 3.3 (this patch was tested on 3.3 only) starts at address &h649 and extends through &h66c. Each entry is 4 bytes long. The first 2 bytes are for the keystroke (or keystrokes if two are needed); the last 2 are for the address of the WordStar *routine that actually performs the action.*

If you don't want to give up your brackets, you can use Ctrl-[and Ctrl-] instead. To do this, replace the 5b in the second line of Figure 1 with 1B, and the 5d in the third line of Figure 1 with 1D; everything else in the examples remains the same. If you decide you prefer this second method, you'll have to hold down the Ctrl key while hitting the brackets, which is still easier than hitting Ctrl-Q-S and Ctri-Q-D.

This redundant function key trick has many uses. If you want one-key centering, for instance, and don't have any other use for the backward apostrophe, you can add this change at the same time that you're altering the bracket keys above. To do so, follow the instructions in Figure 2. Then any time you want to center a line, just hit the backward apostrophe. The nice part about this is that the old Ctrl-O-C combination will still work too.—P.S.

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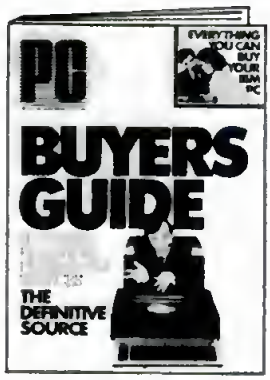

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```
A>DEBUG WS.COM
-e 649 5b 0 ba 7e
-e 64d 5d 0 95 7e
-w
writing 5380 bytes
-q
```

Figure 1: *Instructions for using DEBUG to patch WordStar 3.3's main WS.COM file to let the left and right brackets act as ^QS ond ^QD function keys. Substitute 1B for 5b and 1D for 5d if you want to use Ctrl-[ond Ctrl-] rather than just the brockets themselves.*

```
A>DEBUG WS.COM
-e 651 60 0 34 02
-w
writing 5380 bytes
-q
```

Figure 2: *Instructions for using DEBUG to patch WordStar 3.3's main WS.COM file to let the backward apostrophe act as o one-key centerer (the same as Ctrl-O-C). This assumes you have already entered the two redundant keys in Figure 1: if you haven't, replace the 651 in the second line with 649.*

Slick Mono Tricks

One of the more interesting and possibly useful PC display tricks can be found in the IBM *Technical Reference Manual* in the section titled "Programming the 6845 CRT Controller" (page 2-45 in my edition). A chart on that page lists several 6845 internal data registers, their functions, and their initialization parameters. The page following it lists the port addresses for the index and data registers (&H3B4 and &H3B5). It's easy to change display parameters by changing the contents of the ports with the BASIC OUT statement. For instance,

```
OUT &H3B4,2:OUT &H3B5,40
```

shifts the screen to column 40. If your screen is full of text, all the text would shift quickly past the right margin and start "curving" around the *back* of the screen. You would see some characters printed enlarged and backward along with the regular-size and -face text. The MONOFUN1.BAS program in Figure 3 shows an application of this trick similar to one I saw at an IBM Product Center.

Another fun register is "Max Scan Line Address" (register 9), which fixes the number of scan lines on a single display line. For instance,

```
OUT &H3B4,9:OUT &H3B5,1
```

changes the screen so that only the first scan line of each line is displayed. The MONOFUN2.BAS program in Figure 4 provides an unusual application for this trick.

You can experiment with these ports and get some very odd displays—but be careful. Display crashes are very common. Helpful hint: Make sure you know the default settings, so you can type them in if something goes a little crazy. It can be hard to reset a computer with a flickering screen. Also, note that this is for the monochrome display ONLY. Refer to your technical manual for color card specs.

John Klabo
Seattle, Washington

```
100 ' MONOFUN1.BAS -- by John Klabo, Roger Harui, Nilee Bader
110 ' *** Use on mono soreene only ***
120 CLS:KEY OFF
130 LOCATE 12,30:PNINT STHING$(20,27)
140 LOCATE 13,24:PRINT "Thie ie a demo of Data Negieter 2"
150 FOR X%=1 TO 23:LOCATE X%,79:PRINT CHR$(17):NEXT
160 FOR X%=1 TO 5:FOH Y%=1 TO 700:NEXT
170 FOR Z%=1 TO 82
180 OUT &H3B4,2:OUT &N3B5,Z%
190 NEXT:NEXT
```

Figure 3: *MONOFUN1.BAS program to shift the screen rapidly to the side.*

```
100 ' MONOFUN2.BAS -- by John Klabo, Roger Harui, Miles Bader
110 ' *** Use on mono screens only ***
120 CLS:KEY OFF
130 LOCATE 12,30:PRINT STRING$(20,24)
140 LOCATE 13,24:PRINT "This is a demo of Data Register 9"
150 FOR X%=1 TO 23:LOCATE X%,1:PRINT CHR$(219)
160 LOCATE X%,79:PRINT CHR$(219):NEXT
170 FOR X%=1 TO 5
180 FOR Z%=11 TO 14:FOR Y%=1 TO 1000:NEXT
190 OUT &H3B4,9:OUT &H3B5,Z%
200 NEXT:NEXT
210 OUT &H3B4,9:OUT &H3B5,13
```

Figure 4: *MONOFUN2.BAS program to wiggle the screen up and down (for mono monitors only).*

These are interesting, attention-getting tricks. The 6845 chip at the heart of both the mono and color graphics boards is capable of far more than the PC normally allows, and is easily programmable. However, the Tech Manual *is not crystal-clear on how to do some of the more bizarre things with it. For such advanced tricks, it's best to consult one of the few color graphics books on the market that include sections on 6845 programming.*

Non-Batch FORs

I'd like to comment on a letter from David P. Sykes concerning the use of the DOS FOR command ("FOR Play," User-to-User, *PC*, Volume 3 Number 24).

Mr. Sykes, as well as other readers of your column, will be happy to learn that although the syntax is slightly different, the FOR statement does indeed work from the DOS command level—not just from within .BAT files as Mr. Sykes states.

To issue a "repeating" FOR command that will be correctly expanded by the DOS COMMAND.COM shell, just omit one of the percentage signs in front of the file variable.

For example, to successively edit all of the .XTK files on one of your diskettes, enter

```
FOR %A IN (*.XTK) DO EDIT %A
```

(Remember to replace "%A" with "%%A" if you intend to place this command line inside a batch file.)

I recently needed to update 20 or so assembler source files, reassemble them all, and then update an object module library. The following sequence of commands, entered at the DOS prompt A>, did the trick quite nicely:

```
A>FOR %A IN (*.ASM) DO ED %A
A>FOR %A IN (*.ASM) DO MASM
  %A;
A>FOR %A IN (*.OBJ) DO LIB
  SAMPLE.LIB-%A+%A;
```

While the relatively recent addition of the FOR statement to the DOS programming environment significantly enhanced the power of the DOS batch facility, its use outside of batch files should not be overlooked.

Michael Markowitz
Chicago, Illinois

This does work, and it saves having to create and then run batch files. However, it's sometimes better to add the few extra steps and go ahead and run the FOR statement out of a batch file if it is very complex. You can, of course, enter this with an ASCII word processor and then adapt it later to your precise needs. Users invariably find themselves repeating processes because they forgot something or changed something, and it's far easier to run a batch file then have to retype the whole long statement at the command level.

POKE vs. PRINT

The NEWPRINT.BAS program in Figure 5 can be used in either interpretive or compiled BASIC programs to replace the PRINT statement. NEWPRINT pokes the

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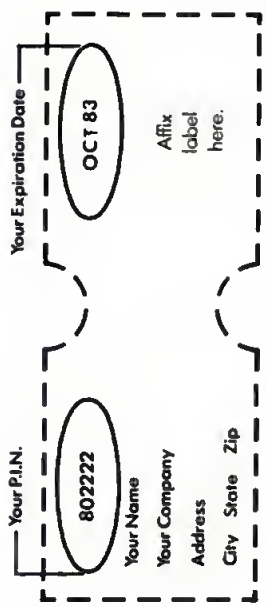

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```
100 ' NEWPRINT.BAS -- replaces PRINT routine -- by Bert Sirkin
110 CLS:KEY OFF:DEFINT A-Z                  'setup
120 DEF SEG=&HB800                          'use &Hb000 for mono
130 PR$=STRING$(80,65)                      'string to print
140 C=1                                     'define starting column
150 R=10                                    'define starting row
160 CL=7                                    'define starting color
170 GOSUB 200:END                           'do it, then quit
180 ' *** PRINT rountine ----------------------------------------
200 J=0                                     'initialize string pointer
210 ST=(R-1)*160+(C-1)*2                    'initialize video memory start
220 FOR I=ST TO ST+LEN(PR$)*2-1 STEP 2      'loop until end of string
230 J=J+1                                   'increment string pointer
240 POKE I,ASC(MID$(PR$,J,1))               'POKE ASCII character
250 POKE I+1,CL                             'POKE color attribute
260 NEXT                                    'loop back
270 RETURN                                  'jump out of subroutine
```

Figure 5: *NEWPRINT.BAS program that POKEs characters and attributes directly to the screen memory rather than PRINTing them.*

ASCII value of a key and its color attribute directly into memory, which allows you to wrap past the end of a row without having to worry about an illegal-function error. It also lets you print characters on the 80th column of the 25th row without scrolling your screen up a line.

This routine takes approximately 1.8 times longer than the normal interpretive PRINT statement to print strings, but it is about 45% faster than PRINT when compiled. And while it is not as fast as an assembler routine, unlike an assembler call, it can be used both when compiled as well as with a program that you are debugging with the interpreter.

Line 120 sets the video memory segment. Be sure to use &hb800 if you have a color screen and &hb00 for mono. Line 130 defines the string to print (in this case 80 As). Lines 140 and 150 tell the program

```
100 ' Forwards/Backwards Typer -- By PC Magazine
110 CLS:DEFINT A-Z:KEY OFF
120 DEF SEG=&HB800                          'use &Hb000 for mono
130 DEF FNST(R,C)=(R-1)*160+(C-1)*2
140 INPUT "Pick a color (1-255): ",K
150 INPUT "Pick a row (1-25): ",R
160 INPUT "Pick a column (1-80): ",C
170 PRINT "Type <F>orewards or <B>ackwards (F/B)?"
180 I$=INPUT$(1)
190 I$=CHR$(ASC(I$) AND 95)
200 CLS:PRINT "Now start typing (or hit escape to quit)"
210 A$=INPUT$(1)
220 IF A$=CHR$(27) THEN END
230 POKE FNST(R,C)+1,K
240 POKE FNST(R,C),ASC(A$)
250 IF I$="F" THEN C=C+1 ELSE C=C-1
260 GOTO 210
```

Figure 6: PC Magazine*'s adaptation of the trick in NEWPRINT.BAS to let you type foreward or backward. Try row and column values of 10, especially if you want to type backward. If you have a color monitor, try a color value of 116 or 113.*

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where to start printing the string on the screen. Line 160 defines the color in which to print the string. The formula for translating colors into a number is: CL = (FG AND 16) * 8 + (BG AND 7) * 16 + (FG AND 15), where FG is the foreground color and BG is the background color.

The stripper I use most often in BASIC programs simply removes the spaces on either side of a number, since they can be unsightly.

For example, try adding the following groups of lines to the program. Each will print the same string:

```
121 ' using PRINT
122 LOCATE 10,5
123 COLOR 15,0
124 PRINT "test":END

121 'using NEWPRINT
122 R=10:C=5:CL=15
123 PR$="test"
124 GOSUB 200:END
```

Bert Sirkin
Windsor, Connecticut

This method does print characters more quickly than PRINT when compiled, but it's painfully slow in interpretive BASIC. However, the trick has other uses. See Figure 6 for a small program that allows you to type into the keyboard and have the output printed foreward or backward.

*Also, the color formula described above seems a bit complex. A far simpler version is simply: CL = background * 16 + foreground.*

My Favorite Stripper

Line 110 of Figure 7 contains the stripper I use most often in BASIC programs. This simply removes the spaces on either side of a number. BASIC prints a space to the left of a number to use for a negative sign, when appropriate. The DEF FNST$(Z) defined function will do away with this space, so it really doubles as an absolute value function (except that FNST$(Z) turns numbers into strings while ABS(Z) returns numerical values). BASIC also prints a space to the right of a number, and DEF FNST$(Z) gets rid of this as well. I find it's much cleaner and easier when I'm mixing text and numbers to treat everything like strings, and this makes it simple. Otherwise, BASIC pads every positive number with an extra space, which can be unsightly.—P.S.

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```
100 ' NUMSTRIP.BAS (not for negative numbers)
110 DEF FNST$(Z)=RIGHT$(STR$(Z),LEN(STR$(Z))-1)
120 INPUT "Enter a number: ",N
130 PRINT "***";N;"***"
140 PRINT "***";FNST$(N);"***"
```

Figure 7: *BASIC program containing a defined function to strip leading and trailing spaces off of numbers.*

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A Line on Investments: Knowing the Value

Don't buy the champagne yet! Value/Screen doesn't guarantee you'll make a killing in the market or instantly give you crystal-ball vision. But it can improve your financial analyses.

Value/Screen is an investment package that offers users an easy way to analyze investment data and gain new perspectives that would otherwise require excessive effort.

Its database contains a mountain of information on more than 1,600 of the most actively traded stocks. The package allows you to query and sort in numerous ways, using your own criteria. You can then generate reports that display pertinent financial and statistical data related to your findings. You can also construct several different portfolio strategies to determine which seem to be more successful over time.

Value/Screen was developed by Value Line, Inc., a well-respected organization with more than 50 years of Wall Street experience. The company is best known for its *Value Line Investment Survey*, the country's leading investment advisory publication, which has more than 110,000 annual subscribers.

Upon subscribing to *Value/Screen*, you receive an operating manual with a data diskette, a portfolio management and analysis diskette, and a program diskette. Each month you receive a new data diskette with updated financial information. The data diskette contains a compilation of annual and quarterly financial records for more than 1,600 industrial, transportation, utility, retail, and financial companies. It also contains Value Line's proprietary investment measures: Timeliness, which predicts a stock's relative performance in the coming year on a scale of 1 to 5; Safety, which ranks a stock's future stability; Financial Strength, giving stock price projections for 3 to 5 years ahead; and others. Altogether, 32 variables are maintained for each stock record. The data variables are grouped into four categories: valuation measures, market data, historical performance, and estimates and projections.

At the heart of any database is the power to query (*Value/Screen* calls it screening) and to sort information. You first choose a variable and value, then narrow your search by adding more variables one at a time. For example, if you choose Timeliness and make the first screening criterion less than or equal to two, you will find that 390 of the original 1,620 stocks fulfill this requirement, as seen in Figure 1. Adding two other variables—Percentage of 3- to 5-year Appreciation, and Financial Strength—reduces the number of stocks to consider to 33. The 32 variables give you a large range of ways to query the system and gain insights that would otherwise be unattainable.

With the data diskette, you can perform statistical analyses on any group of stocks. For any data variable, you can determine the mean, high-low data values, variance, and standard deviation. This statistical feature is available for the entire database or for a subset of stocks

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Illustration: Yvonne Buchanon

that you have screened. Using this feature, you can see how a screened subset compares statistically with the entire database.

Using *Value/Screen*'s report feature, you can examine the stocks that fall within the screening criteria. A screening and reporting process can be performed in 5 to 10 minutes. The data diskette also allows you to generate a detailed report on any specific stock.

After preparing all the reports and statistical analyses you desire, you can preserve the list of stocks that resulted from your screening process for further consideration at a later date. The portfolio management and analysis diskette allows you to save up to 40 ticker lists of screened groups and to build 20 different portfolios.

Portfolio Building

The portfolio diskette offers some valuable capabilities, but if you have spreadsheet software, you might consider using it instead to build your portfolios. *Value/Screen* requires that you build your portfolios by entering the company name, number of shares, price paid, recent price, and date of purchase. The two report formats available on the portfolio disk—Information Summary and Valuation Report—are useful, but hardly as complete as a spreadsheet.

One very practical feature of the portfolio disk is the ability to load monthly pricing data directly into your portfolios for various types of analysis. With a 6-month-old data diskette (remember, you get a new one every month), you could quickly run Valuation Reports, allowing you to compare your portfolio's performance prices from 6 months ago against its performance at current prices.

Once you have built a portfolio list, *Value/Screen* lets you perform other standard operations such as adding and removing stocks, updating pricing information of your own, and directing file retrieval and deletion.

Value/Screen is simple enough to use, the operating manual is clearly written, and the software leads you through the operating steps. It takes little time to begin operating *Value/Screen*, but a significant time is required to learn the important questions to ask.

It's a Breeze, But . . . .

Value/Screen is so easy to use that you can begin querying, reporting, and building portfolios the day you receive your package. Be warned, though, that for the less sophisticated user, this would be a mistake. Although the manual gives you concise definitions for the 32 variables, you may need to do some additional research to appreciate their meaning fully and to understand variable interrelationships.

Because you receive the database on disk, you are likely unaware of what it contains. I recommend that you generate a complete hard-copy list of the data as one of your first reports. Examine and spot-check this list so that you can better understand the database and determine the appropriate amount of faith you should have in it. Keep this complete database list. If your queries do not uncover stocks that you are sure will fall within your criteria, check it against your complete list to understand why they are not shown.

I was disappointed to find that my printed list uncovered industry codes that were not identified in the *Value/Screen* manual. In addition, and understandably so, certain variables either aren't applicable to certain stocks (NA) or are nonmeaningful (NMF). For example, the annual sales variable for banks and insurance companies is not applicable. To set a limiting criterion on this field would automatically eliminate this group of stocks from consideration and thus may not be what you want. You need to understand the complete database to use it properly, and this may take some time.

Insight, Not Foresight

Value/Screen is a powerful tool for considering investment strategies, but it cannot and does not claim to guarantee sure-fire success in the stock market. Analyzing data is not enough to make wise investment decisions, although it helps. *Value/Screen*'s data cannot predict potential strike activities, nor can it show technological changes and new product developments that can affect competitive stances. It may or may not accurately predict the effect of future economic changes in factors such as inflation and interest rates. *Value/Screen* is not a crystal ball, so avoid thinking of it as a guide to the future.

Value/Screen's greatest strength lies in its ability to let you create and test the performance of several different investment strategies. Of course, the success of any past strategy does not assure that it will be equally successful in the future. But as the manual says, it obviously helps to test a strategy on paper before committing your funds. That certainly makes sense to me. ■

```
1 TIMELINESS          9 RECENT PRICE      17 DEBT/CAPITAL      25 EBT % CHG EPB Q1
2 SAFETY             10 CURR P-E RATIO    18 % RTN/NET WORTH   26 EST % CHG EPS Q2
3 INDUSTRY RANK      11 CURRENT DIVD YLD  19 % RETO/EQUITY     27 EBT % CHG EPS FY
4 INDUSTRY CODE      12 PRICE/BOOK VAL    20 5-YR EPS GROWTH   28 PROJ EPS GROWTH
5 FINL STRENGTH      13 3-MO % PR CHANGE  21 5-YR DIV GROWTH   29 PROJ DIV GROWTH
6 PRICE STABILITY    14 6-MO % PR CHANGE  22 5-YR BVSH GROWTH  30 PROJ BVSH GROWTH
7 BETA               15 MARKET CAPITLZTN  23 LAST Q EPS % CHG  31 3-5 YR APPREC %
8 OPTION INDICATOR   16 ANNUAL SALES      24 12-MO EPS % CHG   32 3-5 YR TOT RTN

                                                  07/84        1620
                  VARIABLE          ( = )         VALUE     # OF STOCKS
                TIMELINESS            (=           2            390
                3-5 YR APPREC %       )          100            206
                FINL STRENGTH         =)          A+             33
     INPUT NUMBER-->
-------------------------------------------------------------------------------
      INPUT # OF ITEM AND PRESS (RETURN); OR PRESS (RETURN) TO EXIT
```

Figure 1: Here are 3 of *Value/Screen*'s data variables, showing the number of stocks to consider.

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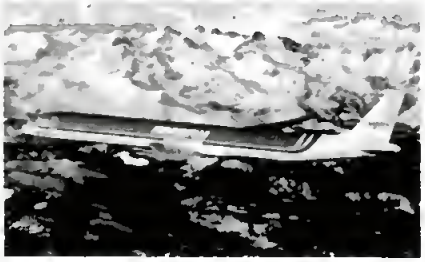
CIRCLE 184 ON READER SERVICE CARD

Company Offers FREE OVERNIGHT DELIVERY!!!

New customer service policy expected to set a new standard in the mail order industry!

BY MICHAEL CHRISTOPHER

GARDEN CITY, N.Y.—Mr. David W. Pasternack, President of Logicsoft, a major IBM PC software and hardware distributor, has announced the inception of a unique new customer service policy. . . .free overnight courier delivery on their entire product line.



In a recent interview, Mr. Pasternack stated that "We feel our new free overnight delivery service will set a new standard in the computer software mail order industry. In a study we conducted, we found that in addition to competitive pricing, expedience was a factor utmost in our customer's minds. Whether their order was $300 or $3000, the need to get their package as soon as possible was the same. Under our old procedures, between processing and shipping time, it could take up to a week and a half to two weeks for an order to arrive. With our new courier service, an order can be processed, shipped,and arrive in our customer's hands in only 3 working days. . .at no additional charge!"

The company is using Emery Worldwide to handle the large number of packages being shipped each evening for next day delivery. "We chose Emery for their competitive pricing structure and excellent delivery record", said Mr. Pasternack. Emery was quoted as saying, "This makes Logicsoft the largest single Emery account in the New York Metro area.

LOGICTIP OF THE MONTH

Choosing software can be mind-boggling. With the proliferation of publishers, how do you choose. Analyze your needs. . . what specific tasks do you want to perform. Read the software reviews; an excellent way to evaluate a package. Ask around. . . you'd be surprised how many associates may be using a package similar to your application. Finally, choose the best package (not always the most expensive). Upgrading will end up costing you more. Remember the key word is research.

Logicsoft's Lowest Price Guarantee Still Effective

GARDEN CITY, N.Y.—Logicsoft, Inc. has indicated that their long time policy of guaranteeing the lowest prices in the mail order market is still being offered and will not be affected by their new free overnight delivery service. "We will continue to beat any price by $10" a company spokesman said. "We'd be crazy to fool with success", he stated; "since the inception of our lowest price guarantee, sales have skyrocketed."

When asked how Logicsoft could afford to give their customers free overnight delivery plus beat any price by $10, they replied "Buying Power". "Very simply", they said, we buy at the best possible prices and pass those savings along to our customers".

CONTINUOUS STATIONERY: BIG BUSINESS, But "Where's The Class?"

NEW YORK—The growth of Logicforms, Inc., a member of the Logic Group, has been phenominal. Mr. Ralph Corso, President of Logicforms explains why. "Up until now, buying continuous stationery through the mail has been a take what's available situation". "First off", he said, "almost all mail order firms offer only stock letterheads & envelopes with limited typestyles, colors and stock logos from which to choose, but, 'where's the class'?"

"The individual style and design of a letterhead", said Mr. Corso, "reflects the professionalism and personality of a company and should not have to change because they now have a printer and the need for continuous stationery. While other mail order firms are limited in the variety they can offer, Logicforms *specializes* in custom stationery. Logicforms offers a large selection of quality paper, ink colors and special effects such as thermography, blind embossing, foil stamping and multi-color printing." Mr. Corso went on to say that "whether a customer chooses to supply his own artwork or printed letterhead, *or* wishes to select from our vast array of stock designs. . .We are the Logical Choice".

For a free sample/pricing kit and a handy re-usable shipping envelope for artwork, simply call toll-free 1-800-645-3491 or send a sample of your current stationery for a free firm price quote. Mail to Logicforms, Inc., 300 Garden City Plaza, Garden City, N.Y.11530

TOLL-FREE SUPPORT A Smashing Success

GARDEN CITY, N.Y.—A survey of Logicsoft's toll-free technical support policy was done to see if it warranted the continued costs of the 800 toll-free number, personnel costs, etc. After careful monitoring of these calls (both pre-sale and after sale) it was found that 92% of the calls were for legitimate technical support questions rather than for answers already contained in the softwares' operations manual. As a result of the survey, the decision has been made to continue toll-free support as an important part of their customer service.

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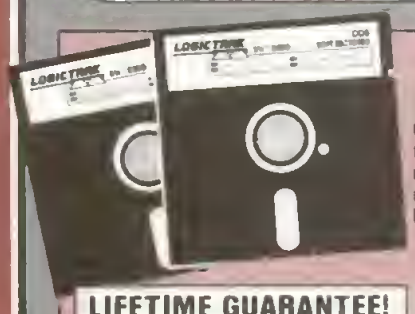

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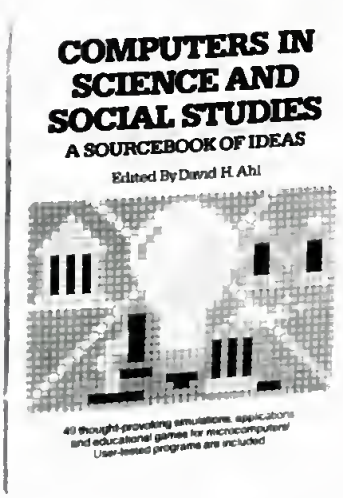

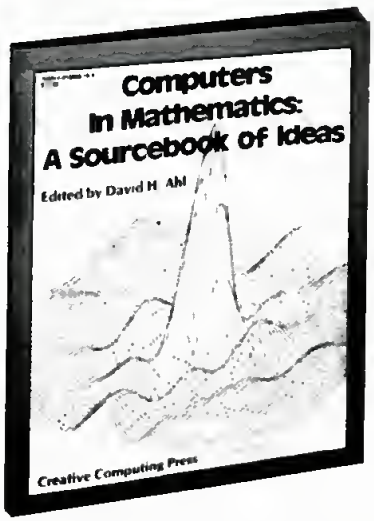

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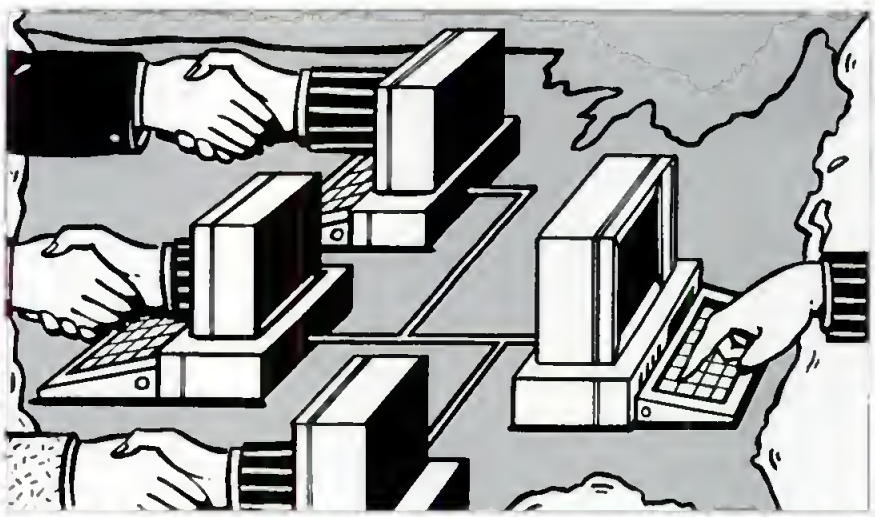
As an advertising salesman handling 300 accounts in 15 states, I decided to computerize my business. I needed a way to organize all my accounts so that my calls would not go unanswered and handling follow-ups would be easier. I realized that a computer might not make me a better salesman, but it has the potential to make me a more efficient one.

My PC came with a package deal that included software from the PFS family Software Publishing Corporation of Mountain View, California. I used the programs to set up my system. The database, *PFS:FILE*, was first. *PFS:FILE* gives you a blank screen you can set up as you wish. You get 3,100 records per database and a massive amount of information per record.

I standardized the key code for each record, using the first four letters of the company name. I gave the Fine Manufacturing Company, for instance, the key code FINE, the American Can Company, ACAN, and American Bottle Machinery, ABOT.

In addition to keeping addresses, telephone numbers, names, and titles, the database helps me store, sort, and retrieve the following information in several fields. (In another industry the database may be different, but many of the applications will be similar.)



Illustration, Brad Hamman

- Call Date. Entered as a number such as 922, which translates as "Contacted on September 22." Directly below this field is a space for a 12-character reminder to tell me why I'm calling the client.
- Code Call. Contains a series of codes including customer rating, type of product, entire advertising schedule or sales order, and what the customer bought from the competition. This information enables me, for example, to call all companies in a category who buy a specified amount of advertising and do not have an ad scheduled for the current issue.
- Ad Schedule. Accommodates 3,100 records and includes a 3-year ad schedule, past, current, and planned, along with what the competitor received and a column for editorial mentions in the current year.
- Trivia. Includes customers' birthdays, their hobbies, and their secretaries' names.
- Comments. Contains what happened at the last meeting or during the last phone call as well as when the last letter was sent.

Neat Data

The database offers the advantages of yellow pads filled with information. But because the database is computerized, the valuable information is neatly orga-

nized in one place. This way I can generate lists sorted by name, title, location, product, advertising level, special interests, or upcoming birthdays. Working with 300 accounts suddenly becomes manageable.

The key to making the system work is updating your records. This can be time consuming at first. But as you become more familiar with the process, the total maintenance time should drop to 2 or 3 hours a week. The report generator—I use *PFS:REPORT*—taps the true capabilities of the computer. On one level, it frees me from mundane tasks such as preparing routine or special lists and updates for superiors. A complete database lets you put any report format you want on paper quickly. The report generator lets you change field names; compute subtotals, totals, and averages; perform math; and pull names from specified categories.

The fun of a report writer, however, is in impressing your clients. Instead of having competitive circulations typed on a letterhead, you can, for instance, print them on 15-inch green bar paper. The result looks quite professional, and the information is absolutely accurate.

With a business graphics package, I also can develop graphics presentations for my clients. To do this, I first create a graph showing sales growth, extended use, or competitive advantages. Then I print out a copy and finally write or dictate the documentation for it.

Follow-up letters can also incorporate graphics. I have my secretary type a letter, leaving 20 blank lines at the appropriate position, and then add a graph with the graphics printer.

```
key:      mag:          date:          call back:          adv:
category:                re:                              who:
initial contact:                 aediex:              aedia aent:

COMPANY:
 atreet:                              AGENCY:
  city :                               block:
  atate:     zip:                        cy :
nk1:          nk2:          nk3:         at :        zip:
phone:                                      #:
 C1:                                        A1:
CT1:                                       AT1:
 C2:                                        A2:
CT2:                                       AT2:
 C3:                                       ak1:                ak2:
names:
GEN'L:
PRDDUCTS:
COMMENTS:

                        Special:
1983   8W          1984 8W:       8I:       84 EDIT:          84 INTERNT'L:
J:              1:               b1:       JN84:                J/F84:
F:              2:               b2:       F884:
M:              3:               b3:       MR84:                M/A84:
A:              4:               b4:       AR84:
M:              5:               b5:       MY84:                M/J84:
J:              6:               b6:       JN84:
J:              7:               b7:       JL84:                J/A84:
A:              8:               b8:       AG84:
S:              9:               b9:       SP84:                S/O84:
D:             10:               b1D:      OT84:
N:             11:               b11:      NV84:                N/D84:
D:             12:               b12:      DC84:
X:             LD:                aa:

1985 BW: JAN85:     FE885:     MAR85:     APR85:     MAY85:     JUN85:
JUL85:     AUG85:     5EP85:     OCT85:     NDV85:     DDR85:
Distributor  1985:                    International 1985:
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```

Your accounts datsbase can be as extensive as your needs demand. Use this sample datsbase setup or design your own format, using more than one screen if necessary.

The Extra Touch

Your computer can also help you generate more business. One tactic I've tried is putting together a newsletter for my accounts. It adds a personal touch, makes the client more aware of me and my company, and increases sales.

My newsletter is simple to prepare. The editors give me a list of items, releases, and articles they're working on. I usually make just one point in the newsletter, under a short, catchy headline. If the client has to spend more than 60 seconds on it, he or she won't read it. I print the newsletter using my dot matrix printer with the enhanced printing function. No fancy production or fine printing is needed. The job can be done in one lunch hour. I send the newsletter to my top 40 accounts and agencies.

For clients who have personal computers, I create an on-line newsletter by printing reports, charts, and information to disk as text files. On one disk you might print reader habits, competitive circulation, and a report on how much advertising space is available at various prices. You can personalize the disk by creating a headline including the client and your company. Then you add an AUTOEXEC.BAT file. When a client boots it, he or she will see the current files. Using public-domain software utilities, you also can add color, encrypt files, or prevent accidental erasure.

I still haven't exhausted the possible benefits the personal computer can bring to sales. If there are enough computers in your industry, open a bulletin board service for your customers to give them access to information and files. Develop an interactive sales presentation instead of the conventional slide show for your next trade show.

The possiblities are endless. You need only imagination to generate ideas and time to put them into practice. ■

Glenn Abelson is an independent magazine advertising salesman and a computer consultant in database management.

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Clinical Uses for Spreadsheets

Integrated business programs, such as 1-2-3, can help doctors monitor everything from primary diagnoses and frequency of appointments to the side effects of drugs.

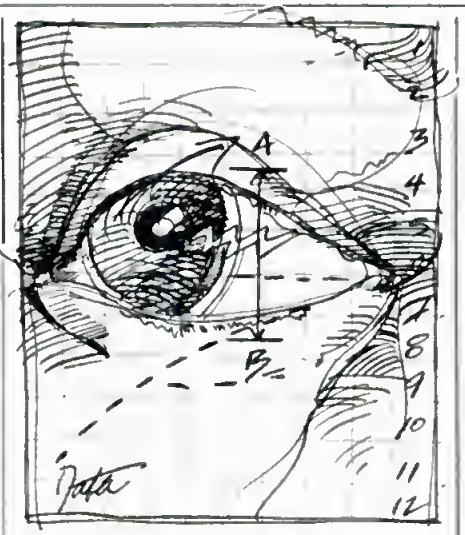
Many physicians are unaware of a practical and affordable way to automate an important part of their practices. They can do this by applying off-the-shelf integrated business programs to clinical record-keeping and analysis. Inexpensive, well-documented packages that combine database managers and electronic spreadsheets can be customized to accommodate the special needs of a medical office.

In choosing an integrated software package, versatility and size are important features to consider. The system must have enough rows and columns in its spreadsheet to accommodate all categories of patient data you anticipate. For my own ophthalmology practice, I use Lotus's *1-2-3*.

Checking on Patients

Once you have a program, you begin by appropriately labeling the spreadsheet columns. The most fundamental biographical items are the patient's name, address, identifying numbers—insurance or Social Security—date of the last visit, and primary diagnosis.

The data you enter in the columns can be sorted in various, interrelated ways. You can, for example, screen the records for patients who have conditions that require reevaluation at least every 6 months. You can then sort a second time,



starting from the date of the last visit. Using the same technique, you can arrange to check regularly on patients who are using drugs that might cause undesirable side effects.

The database manager portion of an integrated package can sort and recall patient records according to any measurement or listed category. This feature is helpful in maintaining contact with people who need continuing care. You can reach patients with diabetes or glaucoma, for example, who are in high-risk groups for loss of vision. Integrated software packages can be programmed to select the patient records that fall within the defined groups, eliminate those who recently have been examined, and then prepare the mailing labels.

So far this method sounds like nothing more than another, more elaborate way of keeping medical records. But the sophisticated statistical and analytical procedures included in integrated software packages represent a qualitative change from all previous recording methods.

Different Stages

Using a grading system that expresses clinical parameters in mathematical equivalents, you can divide a disease process into specific stages and assign each stage a numerical value. As an example, a certain severity of a degenerative retinal disease can be expressed as "stage 2 of 5 stages." You can standardize the entries by including a help file with all of the definitions listed. A help file, permitted by *1-2-3*, can be activated with a macro command, to be incorporated into the spreadsheet. This system makes the transfer or review of records by another physician more understandable and reliable.

Essential to improving medical service is the review of patient charts and procedure records. In most hospitals, medical records already are analyzed according to established criteria for diagnosis, treatment, and outcome. Integrated spreadsheets make it possible for indi-

Illustration: Yvonne Buchanon

vidual physicians to apply the same sort of analysis to their practices. The procedure involves setting criteria for quality of care. For a diabetic patient, for example, the indexes would include glycosylated hemoglobin and blood sugar and cholesterol levels. For a patient with glaucoma, the degree of optic nerve indentation and the intraocular pressure reading would be important. The records can be sorted according to numerical criteria for any combination of listings. All the relevant patient records would then be reviewed and every record with measurements outside the ones indicated can be pulled out.

The spreadsheet's ability to perform repetitive mathematical calculations can be used advantageously. One useful example is an application in my own specialty of ophthalmology.

Lens Calculations

To help patients after cataract surgery, tiny plastic intraocular lenses are implanted routinely into the eye to compensate for the lost focusing power. It is important to accurately calculate the lens power before the new one is implanted. To do this, the axial length of the eye first is determined with an ultrasonographic ruler. This instrument permits sound waves to be bounced off the back of the eye and the echoes measured. Next, a value for the curvature of the front of the eye—the cornea—is established with an optical instrument. Finally, the mathematical constant for that particular lens is selected. Intraocular lenses can be positioned anterior, parallel, or posterior to the plane of the iris. Because the effective focusing power will vary according to the lens location, the constant is specific for the intended location.

The S-R-K formula—often used to find the lens power the eye needs for restoring accurate focusing—is the lens constant minus 0.9 times the mean curvature of the cornea and 2.5 times the eye's length.

The spreadsheet can be formatted so that the calculation is carried out automatically for each patient. You might, for example, set up the spreadsheet so that the axial length measurements of a patient are entered into cell H4, the two readings for the cornea's curvature in cells I4 and J4, and the lens constant in cell K4. At this point the formula can be written into cell L4 as follows:

```
+K4-(I4+J4)/2*0.9-2.5*H4
```

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the entry as a formula. The asterisk indicates multiplication.

Instant Results

As soon as the measurements are entered into the cells, the correct lens power appears in cell L4. The formula can be copied into a range of cells down the column. This feature allows you to create a permanent patient record while simultaneously calculating the lens power.

Other formulas also can be entered to compare the anticipated focusing outcome to the actual result. In this way the lens constant is refined to compensate for variations in both measuring and surgical techniques. Each subsequent calculation then becomes more accurate. Other formulas can be written into the spreadsheet to evaluate other indexes of surgical success such as final visual acuity or the amount of corneal distortion induced by repairing the surgical incision.

Treatment Techniques

Similar techniques can be used for calculating drug dosages, controlling intravenous fluid administration, or in any other area where standardized mathematical protocols are employed. The Boolean functions can vary the dosages according to other parameters. Some drugs dosages are based on the patient's weight but must be altered if there are signs of liver or kidney damage. The calculations can be set up to refer to cells on the spreadsheet where the laboratory data indicating liver or kidney function are entered. The beauty of this *1-2-3*-based system is that once the formulas are entered, complex diagnostic calculations occur automatically, and they never overlook the necessary adjustments.

> The beauty of a 1-2-3-based system is that diagnostic calculations occur automatically.

Integrated database and spreadsheet programs for medical records help physicians handle both regular responsibilities as well as additional functions better. These software tools can dramatically improve medical care and make the science of medicine more nearly exact. ■

Philip Lempert is an ophthalmologist with a practice in Ithaca, New York.

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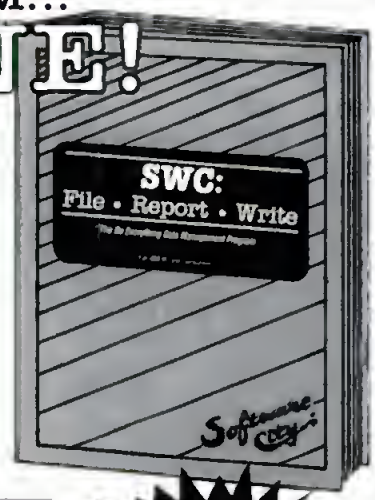

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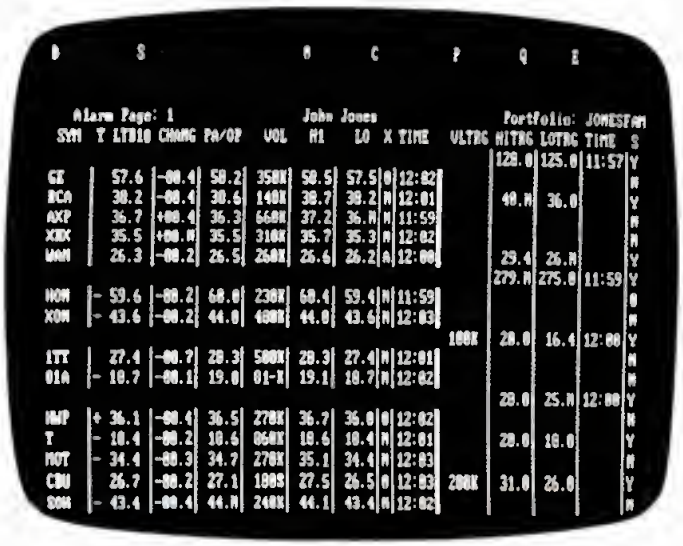

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Making Inroads at the Ivory Tower

IBM seems set on winning over Ivy Leaguers with its generous equipment grants. But its offerings, coupled with agreements reached with some universities, raise ethical questions.

As microcomputers become almost as common on college campuses as frisbees, major computer vendors are vying for the attention of administrators, students, and faculty members. IBM has its eye on the cream of the crop as it unveils a program offering Ivy League schools multimillion-dollar gifts of computing equipment.

Yale, Princeton, Brown, Cornell, and the University of Pennsylvania are among 16 major universities across the country to receive equipment grants this year under IBM's Advanced Education Program (AEP). The grants include mainframes, microcomputers, software, and communications equipment.

Illustration: Brad Hamman

Though IBM spokesmen will not divulge how much the company is spending, Yale values its share at $6.5 million, the largest gift of equipment it has ever received. The $6-million worth of IBM computer equipment promised to the University of Pennsylvania is likewise the largest corporate gift the university has received in its 244-year history. Princeton also will receive a $6-million grant.

"The general intent of the program was to enable schools to do development work in an environment of academic computing," explains J.R. West of IBM Academic Information Systems (ACIS). More than goodwill is involved, however. A gift to today's college students helps build a market for a company's products among tomorrow's engineers and managers. Through similar grants to universities, AT&T bred a whole generation of engineers and computer scientists who consider UNIX the professional's operating system of choice. Apple took a similar tack by establishing the Apple College Consortium, which offers Macintosh computers to college students at significant discounts in exchange for product feedback from university representatives.

More importantly, from IBM's point of view, is that campuses provide the perfect testing ground for the company's pet projects. Big Blue apparently hopes to glean development ideas from the campuses that build large-scale data communication networks out of IBM equipment. The prestige universities provide the best computer science brainpower—and a glittering showcase for IBM products.

The Networking Principle

Each of the 16 schools involved in AEP presented its own development program to IBM, and the equipment grants vary accordingly from college to college. The common denominator is the idea of computerized instruction based on an interactive network of student and faculty workstations. In pursuit of that goal, some of the colleges will emphasize hardware development and others software, particu-

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EDUCATION

larly the development of courseware.

Yale University will receive an IBM 3083 mainframe and 400 personal computers as part of its AEP grant. The university will use this equipment to develop instructional materials in computer science, statistics, biology, architecture, and forestry. Princeton will support seven computing-related educational experiments ranging from engineering to the creative arts.

In spite of the obvious educational benefits, some academics question the basis for the lasting marriage between industry and higher learning. They wonder which one is actually setting the agenda for research and instruction—the university or the corporate sponsor?

IBM Territory?

Under another well-publicized grant program, IBM has entered joint study projects with Carnegie-Mellon and Brown universities. Computer industry analysts believe these sites are the laboratories for the forthcoming IBM "token-passing" local area network. The projects have generated controversy within academic circles because they guarantee to IBM exclusive benefits from university research and development of networked workstations. Also, both institutions have agreed to protect proprietary IBM information, which violates the academic tradition of free disclosure, and to give the company either ownership of or free license to the software products developed on the equipment IBM provides.

The universities involved in the Advanced Education Program maintain that their equipment grants should not be confused with joint-study projects. They admit, however, that the establishment of a university network is a central theme of their programs as well. For instance, Princeton's overall plan calls for constructing a network of 1,000 workstations over the next 7 years in 50 clusters.

"We have made no nondisclosure agreement," says Richard Ferguson, Yale's associate provost in charge of administering the program. "We have no obligation to deliver any product to IBM."

Likewise, MIT's Project Athena, a 5-year, $70-million effort to build a large instructional network on campus with the help of IBM and Digital Equipment Corporation, involves no confidential hardware and leaves proprietary rights in the institution's hands. "These grants are consistent with the ways in which universities have historically been operated," says Professor Steven Lerman, the director of Project Athena.

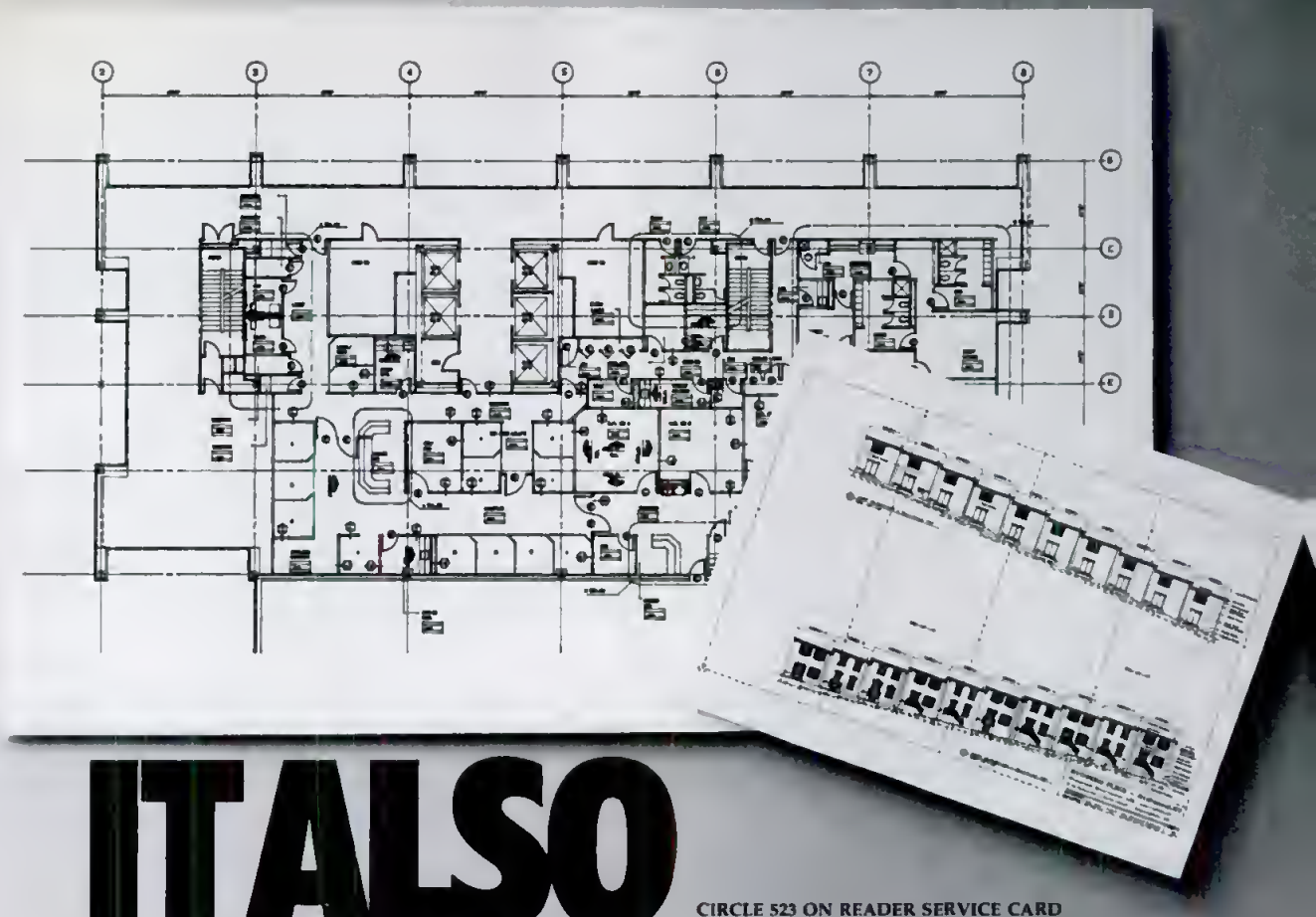
In a university environment that has been an Apple monopoly for several years, ACIS has had considerable success in a very short time. At the Harvard Business School a few years ago, for instance, a grant of PCs led to the creation of computer software for the school's renowned case-study method of instruction. Harvard owns the software and will sell it to other business schools, but it must be run on IBM or IBM-compatible equipment.

Enter All Computers

Still, all the universities surveyed claimed they are resisting the temptation to make academic computing solely an IBM experience. At MIT, for example, officials there foresee a multivendor campus, says Professor Lerman. At Yale, Richard Ferguson says there's no favoritism toward IBM. Ferguson says that negotiations with the Apple College Consortium and with IBM were conducted simultaneously.

Although all universities claim to keep the process of grantsmanship and research as open as possible, they must face up to the dilemmas posed by ever-closer collaboration with big business. So far, college administrators prefer to think that the knowledge interests of the academy are compatible with the profit interests of private companies.

ACIS spokesman Les Szabo believes that in the company's grant program, the long-term needs of IBM and the public interest coincide. ■



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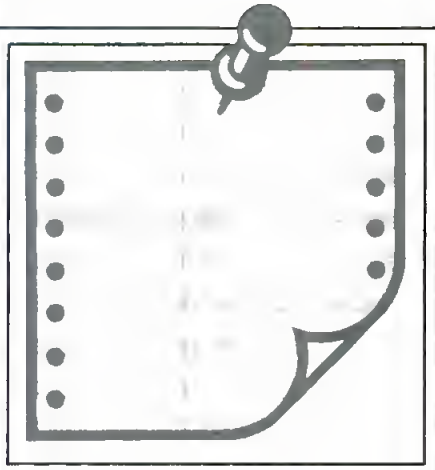

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(206) 967-6732

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Eau Claire Area PC Users Group
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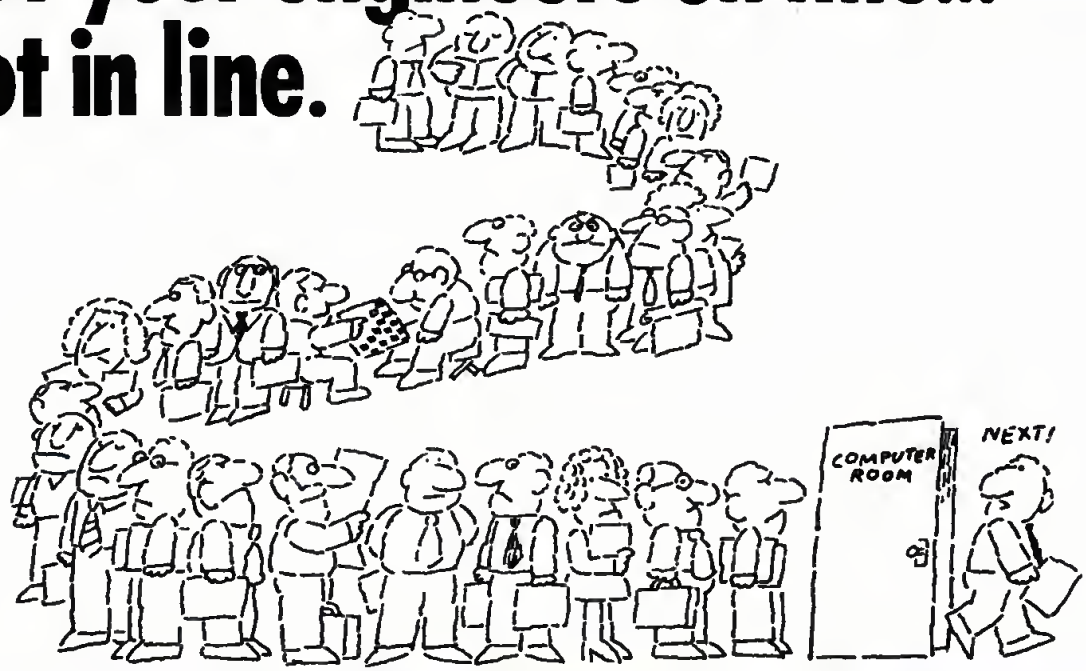


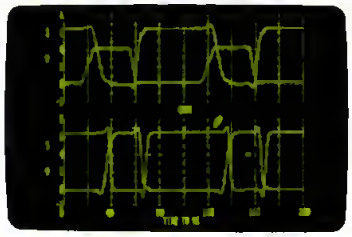
How many long unproductive hours have you spent "in line" for your simulation? Well, no more. MICROCAP and MICROLOGIC can put you on line by turning your PC into a productive and cost-effective engineering workstation.

Both of these sophisticated engineering tools provide you with quick and efficient solutions to your simulation problems. And here's how.

MICROCAP: Your Analog Solution

MICROCAP is an interactive analog circuit drawing and simulation system. It allows you to sketch a circuit diagram right on the CRT screen, then run an AC, DC, or Transient analysis. While providing you with libraries for defined models of bipolar and MOS devices, Opamps, transformers, diodes, and much more, MICROCAP also includes features not even found in SPICE.

MICROCAP II lets you be even more productive. As an advanced version, it employs sparse matrix techniques for faster simulation speed and larger networks. In addition, you get even more advanced device models, worst case capabilities, temperature stepping, Fourier analysis, and macro capability.

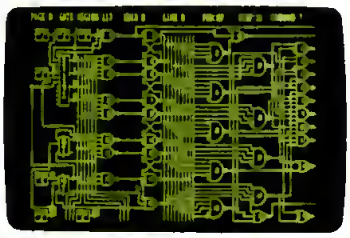


"Typical MICROCAP Transient Analysis"

MICROLOGIC: Your Digital Solution

MICROLOGIC provides you with a similar interactive drawing and analysis environment for digital work. Using standard PC hardware, you can create logic diagrams of up to 9 pages with each containing up to 200 gates. The system automatically creates the netlist required for a timing simulation and will handle networks of up to 1800 gates. It provides you with libraries for 36 user-defined basic gate types, 36 data channels of 256 bits each, 10 user-defined clock waveforms, and up to 50 macros in each network. MICROLOGIC produces high-resolution timing diagrams showing selected waveforms and associated delays, glitches, and spikes—just like the real thing.

CIRCLE 497 ON READER SERVICE CARD



"Typical MICROLOGIC Diagram"

Reviewers Love These Solutions

Regarding MICROCAP . . . "A highly recommended analog design program" (PC Tech Journal 3/84). "A valuable tool for circuit designers" (Personal Software Magazine 11/83).

Regarding MICROLOGIC . . . "An efficient design system that does what it is supposed to do at a reasonable price" (Byte 4/84).

MICROCAP and MICROLOGIC are available for the Apple II (64k), IBM PC (128k), and HP-150 computers and priced at $475 and $450 respectively. Demo versions are available for $75.

MICROCAP II is available for the Macintosh, IBM PC (256k), and HP-150 systems and is priced at $895. Demo versions are available for $100.

Demo prices are credited to the purchase price of the actual system.

Now, to get on line, call or write today!

Spectrum Software
1021 S. Wolfe Road, Dept. F
Sunnyvale, CA 94087
(408) 738-4387

EDITED BY DAVID OBREGÓN

New On The Market

HARDWARE

VPC 2000 Voice Card

A complete voice input/output system on a single plug-in board. The VPC 2000 Voice Card provides voice recognition, speech generation, and telephone management capabilities. With the accompanying *Voice Key Software*, the board can be used for speech command and control of the user's existing programs, without modifications of the user's applications.

For each application program, the user can define up to 64 voice utterances that are linked to sequences of keystrokes of up to 30 characters each. In use, the VPC 2000 Voice Card responds to the defined utterances by automatically entering the stored keystrokes. The keyboard remains active and can be used in a normal fashion.

The board features continuous speaker-dependent recognition (CSDR) technology, allowing the user to speak to the system in a normal conversational tone, without special pauses between words. The board can pick out target words located anywhere within a stream of ordinary conversation. As a substitute for fragmented grammar, a series of commands or data input can be issued through the use of normal sentence structure.

The VPC 2000 can accept and respond to commands issued over a phone line as well. An included utility called the *Telephone Manager* allows the user to access built-in auto-answer, auto-dial, Touch-Tone encoding and decoding, and other hardware-based phone features by using spoken commands.

(List Price: $2,450)
Votan
4487 Technology Dr.
Fremont, CA 94538
(415) 490-7600
Telex: 17-6274

CIRCLE 731 ON READER SERVICE CARD

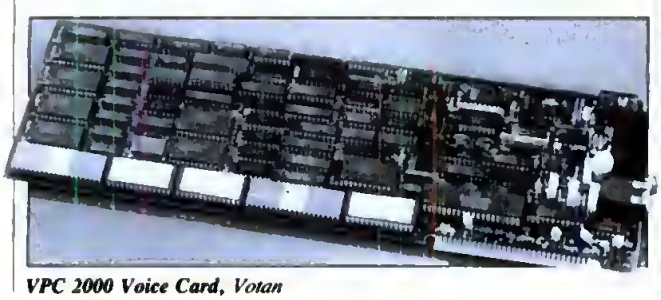
3SPACE Digitizer

A three-dimensional digitizing tablet that is capable of digitizing objects as large as 40 by 40 by 20 inches. Connected to the user's system via a standard RS-232 serial interface, it allows the user to input spatial data for on-screen viewing and manipulation from any viewpoint.

The 3SPACE Digitizer accurately measures the *x*, *y*, and *z* coordinates of chosen points on a model, automatically taking into account the orientation angles of its stylus. The device employs two modules consisting of coils that generate low-frequency electronic fields. The transmitter module, built into the tablet, serves as a fixed source, while the receiver module in the stylus acts as a movable sensor to sample the field. In addition, a separate electronics unit contains the system's analog circuit board, power supply, and digital processor for performing the necessary computations prior to transmitting data to the user's system.

(List Price: $13,900)
Polhemus Navigation Sciences Div.
McDonnell Douglas Electronics Co.
P.O. Box 560
Colchester, VT 05446
(802) 655-3159

CIRCLE 780 ON READER SERVICE CARD



VPC 2000 Voice Card, Votan

Watson

A plug-in board with voice recognition and storage capabilities, tying the IBM PC and any Touch-Tone telephone into a single workstation, combining an integrated electronic phone book, telephone dialer, phone answering machine, calendar and appointment book, and a dictating machine with a 300/1,200-bps modem. Watson lets a user record voice messages directly onto a disk. Data can be entered or retrieved locally or remotely using the keyboard, the signals from a Touch-Tone phone, or verbally. Information entered into a Watson card-type file can be retrieved on any word appearing in that card record. Watson can present the data on-screen or over the phone verbally.

The board uses a number of data compression techniques to overcome the traditional space limitations of storing vocal messages on diskette. Using a mathematical model of the human voice, the board ignores sounds that a voice cannot reproduce, such as background noise. Silences in speech are coded and then eliminated from the final record, automatically reproduced from the code upon playback.

To save space on the board, several features normally associated with spe-

***Watson**, Natural MicroSystems Corp.*

cific IC chips are emulated by Watson's firmware. This approach results in a board with a minimal number of parts, saved space, and improved reliability by limiting the number of components that could fail. The user can choose to order the board with either a 300-bps or a 300/1,200-bps modem.

The board is capable of background operation, handling phone communications automatically while the user works with other applications software. A context-switching feature allows the user to switch back and forth between Watson and whatever tasks are being performed on the PC with a single keystroke. Data stored by Watson on its card file system from phone communications can be transported to other software, such as Lotus's *1-2-3*, for further manipulation.

(List Price: 300-bps, $849; 300/1,200-bps, $998)
Requires: 192K RAM, two disk drives, PC-DOS 2.0, two RJ-11 phone jacks.
Natural MicroSystems Corp.
6 Mercer Rd.
Natick, MA 01760
(617) 655-0700

CIRCLE 778 ON READER SERVICE CARD

Amdek Color 500

A color monitor compatible with either NTSC-composite or RGB-video outputs, with an auxiliary mode to display the output of a video recorder. The Amdek Color 500 provides resolutions of up to 460 dots by 240 lines in RGB mode or 320 dots by 240 lines in NTSC-composite mode. In the RGB mode, a switchable color matrix allows the monitor to display all 16 IBM colors.

Other features of the monitor include a convenient text switch, which enables the user to change text color from white to green for easier reading. A built-in comb filter improves the clarity of both text and graphics in the composite video mode, while a built-in speaker and audio amplifier provides quality sound output. Front-mounted controls include an on/off switch with LED indicator, brightness, contrast, text switch, and volume control.
(List Price: $525)
Amdek Corp.
2201 Lively Blvd.
Elk Grove Village, IL 60007
(312) 595-6890
Telex: 28-0803

CIRCLE 745 ON READER SERVICE CARD

Super Performance Hard Disks

Two standalone hard disks offering 65-MB or 140-MB storage capacities. The drives feature average access times of 30 milliseconds and an 8-millisecond track-to-track access time. They are compatible with any version of PC-DOS and include the hard disk, controller card, host adapter, power supply, cables, and enclosure in a single package.
(List Price: 65 MB, $4,995; 140 MB, $6,995)
Dragon Industries
35 Main St.
Hopkinton, MA 017848

CIRCLE 730 ON READER SERVICE CARD

XT-170 Peacekeeper

An interface board allowing the IBM PC to communicate at high speed with Digital Equipment Corp.'s VAX and PDP-11 DR11-W/B interface-type peripherals. The board transmits 16-bit parallel, bidirectional DMA transfers at 170,000 words per second and allows other similarly equipped PCs to transfer programs and data at high speeds.

Accompanying software is provided for either Pascal, BASIC, FORTRAN, or C languages. It contains a text file explaining the board's operation and three

***Super Performance Hard Disks**, Dragon Industries*

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■ While our specifications certainly speak for themselves, we thought you still might like to hear from some of our users:

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Terry Beptiste, Computerland, Lafeyette, Ca.

■ "Service and support is great, which is an unusual experience. Emerald's software for backup and restore is invaluable. Can't put a price on it. Productivity and efficiency has increased at least 50%!"
Bruce Kittinger, Pinon Systems, Ft. Collins, Co.

■ Runs like a champ with 3-Com Ethernet."
Alvero Ramirez, Micro Age, Miami, Fl.

■ ". . . high capacity and flexibility. At last, a tape back up we can count on. And the price is right!"
John Acres, EDT, Las Vegas, Nv.

■ "The speed at which you can back up is very impressive."
Jim McEwen, Mercy Hospital, Portland, Me.

■ "When Emerald says your unit will be there on Thursday, it's there on Thursday! Delighted we were able to exceed the usual 32 megabyte restriction."
Steven Mayer, Take One Company, New York, N.Y.

■ "The Emerald 65 MB hard disk is extremely easy to install and work with. Emerald has a complicated piece of equipment made easy to use."
Tom Edler, Jewish Hospital, St. Louis, Mo.

■ "Our Emerald fixed disk installed quickly and easily. Emerald's reliable disk and tape backup further enhances LIBRA's high function accounting software."
Kenn White, Libra Progremming, Salt Lake City, Ut.

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CIRCLE 111 ON READER SERVICE CARD

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And with The Bernoulli Box, *now* you can.

This unique cartridge data management system, attached to a standard IBM AT without the hard disk, creates a powerful processing package that only mass storage capabilities can make possible. A package with all of the performance and reliability you only thought possible with a Winchester-enhanced IBM AT, but with dramatically more versatility and dramatically less cost per megabyte.

The secret is virtually indestructible, go-anywhere, 10-megabyte cartridges whose proprietary technology has proven The Bernoulli Box the superior storage solution for a whole range of business micros from the IBM PC to the Macintosh,™ from the XT to the AT&T.

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IOMEGA Corporation
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Roy, Utah 84067

THE BERNOULLI BOX™

CIRCLE 206 ON READER SERVICE CARD

files that are linked with the user's application program.

The XT-170 Peacekeeper fits into any long slot in the PC and comes with two 40-pin connectors compatible with the DEC DR11-W/B interface cards.
(List Price: $995)
IGC Inc.
400 Oser Ave.
Hauppauge, NY 11788
(516) 231-0006

CIRCLE 750 ON READER SERVICE CARD

IDAS 500

An intelligent data acquisition system providing 128 channels, 14-bit resolution, 50 kHz throughput, and local microprocessor control. A key feature of the unit is VERSASCAN, a versatile scan sequence routine that can poll any of the 128 channels in any order, any number of times within a sequence of 1,024 readings.

Other features include real-time channel monitoring, selectable display formats (binary, decimal, hex, or volts), and programmable conversion rates. The IDAS 500 also includes 4 KB of FIFO memory and four channels of analog output.

Configuration routines can be downloaded from the host computer through the standard RS-232 or optional IEEE-488 port. By using these ports, the unit frees the direct memory access interface in the user's system for other tasks, as well as helping to reduce communications overhead and speeding data transfers. All IDAS 500 units have a standard interface for the IBM PC with a DMA transfer rate of 1 MB per second.
(List Price: $4,995)
Phoenix Data, Inc.
3384 W. Osborn Rd.
Phoenix, AZ 85017
(602) 278-8528
TWX: 910-951-1364

CIRCLE 748 ON READER SERVICE CARD

BITS Model UPS-310

An uninterruptible power supply featuring near-instantaneous transfer times to either the internal or user-added backup batteries and a complete instrumentation panel. During normal operation, the unit supplies up to 310 VAC of regulated power, which is isolated from line noise and interference. The output waveform is designed to optimize the performance of switching power supplies in personal computers and peripherals.

The BITS Model UPS-310's instrumentation includes a ten-segment multiple-color bar graph display that indicates either power output level or battery level. A six-digit LED clock indicates correct time during normal operation and becomes a backup timer if line power fails. The unit also includes audible and visual alarms as standard features.

The internal, sealed lead-acid batteries provide a minimum of 10 minutes of backup; with external backup batteries attached to the unit's expansion jack, backup times can be extended without limit. The unit is housed in an enclosure designed to complement the IBM PC.
(List Price: $895)
BITS Power Systems Inc.
11020 Audelia Rd., #8114
Dallas, TX 75243
(800) 527-1378
(214) 340-1208

CIRCLE 773 ON READER SERVICE CARD

AT-FileSafe Tape Backups

Two internal, half-height tape backup units designed for the recently announced IBM PC AT. The two models, FS127-AT and FS160-AT, provide formatted storage capacities of 27 and 60 megabytes, respectively, and are compatible with PC-DOS 3.0. They are also compatible with the leading networks supported by the PC AT, including 3Com's EtherNet Series, Novell, Orchid's PCnet, and NESTAR.

The menu-driven interface allows a PC AT's 20-MB hard disk to be backed up in streamer mode in ap-

BITS Model UPS-310, BITS Power Systems Inc.

The end of your

SOFTWARE

Aptec *(for color Prism Printers)*
Rainbow Writer Color Text Formatter 119.
Rainbow Writer Screen Grabber ... 69.
Ashton-Tate
dBase II ... 255.
dBase III ... 355.
Framework ... 355.
Best Programs
Personal Finence Program ... 65.
PC/Professional Finance Program II 149.
PC/Fixed Asset System ... 297.
PC/Tax Cut ... 129.
Bible Research
THE WORD *(KJV Bible - 7 disks)* .. 145.
Borland International
Sidekick ... see special
Sidekick (unprotected) ... see special
Turbo Pascal ... see special
Financier
Financier II ... 115.
Financier Tax Series ... 97.
Funk Software
Sideweys ... 45.
Harvard Software
Harvard Project Manager ... 219.
Harvard Total Project Manager ... 279.
Lifetree
Volkswriter Deluxe *(with TextMerge)* 159.
Living Videotext
ThinkTank ... 109.
Lotus Development
1-2-3 *(version 1A)* ... call
Symphony ... call
Micro Education (MECA)
Managing Your Money ... 119.
Micropro
WordStar ... 179.
WordStar 2000 ... 259.
WordStar 2000 Plus ... 299.
Microrim
R:base 4000 ... 259.
Extended Report Writer ... 85.
Clout ... 119.
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Multiplan *(version 1.2)* ... 125.
Microsoft Word *(version 1.15)* ... 239.
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Microsoft Project ... 155.
Microsoft Chart ... 155.
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PCcreyon II ... 39.
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CREATABASE ... 47.
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Norton Utilities ... 49.
Norton Utilities *(new version)* ... 65.
Rosesoft
Prokey 3.0 ... 89.
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PFS:File ... 85.
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through February 28, 1985

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MultiMete *(version 3.3)* ... 259.
Warner Software
The Desk Organizer ... 139.

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CP/M-86 PC-DOS (2.1)
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AST-5251 ... 529
AST-3780 ... 589.
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PC perplexities.

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Hayes
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Smartmodem 1200 ..... 459.
Smartmodem 1200B *(w/Smartcom II)* 389
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IOMEGA
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key tronic
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Mouse Systems
PC Mouse (w/software & desk pad) 129.
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NEC
Spinwriter 2050 *(3550's little brother)* 699
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All Orchid Boards come with PCnat Drive (Ram disk). PCnet spool (print spooling), disk caching & partitioning.

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Princeton Graphics
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CIRCLE 339 ON READER SERVICE CARD

PC CONNECTION®

proximately 10 minutes. Files can be restored on a file-by-file basis, or selected groups of files can be restored as needed. All files in a subdirectory, or all files created or changed on a particular day, may also be restored at one time. The system also allows backup and restore procedures to proceed automatically through batch files.
(List Price: 27 MB, $1,595; 60 MB, $1,695)
Mountain Computer, Inc.
300 Pueblo Rd.
Scotts Valley, CA 95066
(408) 438-6650

CIRCLE 728 ON READER SERVICE CARD

SOFTWARE

PC-Font

A printer configurator program allowing the Epson or IBM Graphics printers to print 243 of the 256 possible ASCII characters; the remaining 11 characters are used for printer control. The extended character set includes block graphics, engineering and scientific characters, foreign languages, and other special characters.

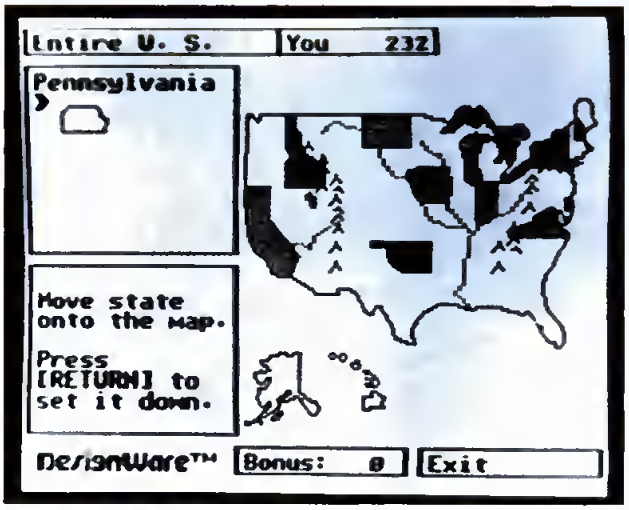
PC-Font allows the user to easily control the size, style, and density of printed material. There are 26 different font combinations for Epson printers, and 13 font combinations for the IBM Graphics printer. In addition, line spacing can be set or changed at will.
(List Price: $24.95)
Requires: 96K RAM, one disk drive, PC-DOS, Epson printer with Graftrax or IBM Graphics printer.
SJL
4473 Marlborough, #5
San Diego, CA 92116
(619) 284-4340

CIRCLE 759 ON READER SERVICE CARD

Drug Interactions

An aid to medical professionals designed to indicate possible adverse interactions between drugs prescribed for a patient. *Drug Interactions* produces a patient-specific printout of the effects that each drug has on other drugs a patient may also be taking. Information on over 500 drugs is included, with over 3,800 entries included in its data file.

The program compares each drug entered by the user against all drugs and effects stored in its data file. For example, if 20 drugs are entered, the program makes over 62,000 comparisons searching for interactions. *Drug Interactions* comes with a manual and an alphabetical list of the drugs (generic or brand name) that the program will recognize. Periodic updates of the data file are planned.



States and Traits, DesignWare, Inc.

(List Price: $89)
Requires: 128K RAM, one disk drive, PC-DOS, printer.
Dr. Richard H. Jeffries
4600 Custer Dr.
Harrisburg, PA 17110

CIRCLE 723 ON READER SERVICE CARD

States and Traits

An educational game program challenging the player's knowledge of U.S. geography, topography, and history. The user is presented with two options: *States* or *Traits*. In *States*, the labeled outline of a state appears on the screen next to a map of the U.S. or one of four regions. Using a joystick or keyboard, the player must position the state onto its proper location on the map. The player may choose to play with unlabeled state outlines; the master map shows only major geological features, adding to the game's challenge.

If the player chooses the *Traits* option, the game challenges the player to plot topological features onto the master map and to answer questions on a range of United States landmarks, historical facts, and current trivia. Unlike games that require the user to type answers in, *States and Traits* puts the user in the active role of actually moving icons and images on the color displays.
(List Price: $44.95)
Requires: 64K RAM, one disk drive, PC-DOS, color monitor, color/graphics adapter.
DesignWare, Inc.
185 Berry St.
San Francisco, CA 94107
(415) 546-1866

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*—PC PRODUCTS MAGAZINE**

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CIRCLE 133 ON READER SERVICE CARD

Instagraphic CRT Print Imager, Eastman Kodak Co.

ACCESSORIES

Instagraphic CRT Print Imager

A new addition to Eastman Kodak's line of CRT imaging hoods, featuring separate hoods for a range of CRT screen sizes. In addition to its standard instant-print photography capability, the new unit accepts a 35mm camera for conventional color slides and prints of screen images.

A complete Instagraphic CRT Print Imager outfit consists of a professional-use Instagraphic camera back, a print module with shutter and variable-focus lens, and the CRT cone. To this, the user adds a cone adapter appropriate to the monitor to be photographed. Cone adapters are available for 9-, 12-, 13-, and 19-inch video or computer screens. Once in place, the adapter forms the base of the outfit, providing the correct lens-to-screen focal length and partially correcting for screen distortion.

An adapter bracket allows the user to replace the Instagraphic camera back with a 35mm SLR camera. *(List Price: $400; cone adapters, $40 each)*
Eastman Kodak Co.
343 State St.
Rochester, NY 14650
(716) 724-3169

CIRCLE 689 ON READER SERVICE CARD

VU-TEK Anti-Glare Filter

A polarized antiglare filter. The filter allows light to pass through it in one direction only, eliminating ambient light reflections and increasing character legibility by raising the contrast ratio between a display's foreground and background.

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American Hoechst Corp.
805 Via Alondra
Camarillo, CA 93010
(805) 987-5026

CIRCLE 688 ON READER SERVICE CARD

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An acrylic stand for IBM, Epson, Micronics, and similar lightweight printers. Available in either clear or smoked ¼-inch acrylic, the TILT-VU stands come in two sizes: C10 (clear) and S10 (smoked) models accommodate 10-inch platen printers; the C15 and S15 models hold printers with 13- or 15-inch platens. *(List Price: $44.95–$59.95, depending on size and color)*
DG Products
P.O. Box 20314
Raleigh, NC 27619

CIRCLE 743 ON READER SERVICE CARD

STATIGLASS Anti-Static Cleaner

A CRT display cleaning fluid designed to minimize or eliminate static electrical charges without leaving a residue. The aerosol cleaner is available in single 18-ounce containers, or packed in cases of 12 containers. *(List Price: $2.85 each; case, $30)*
Statikil, Inc.
1846 N. Cleveland-Massillon Rd.
P.O. Box 2657
Bath, OH 44210
(216) 666-3701

CIRCLE 736 ON READER SERVICE CARD

VU-TEK Anti-Glare Filter, American Hoechst Corp.

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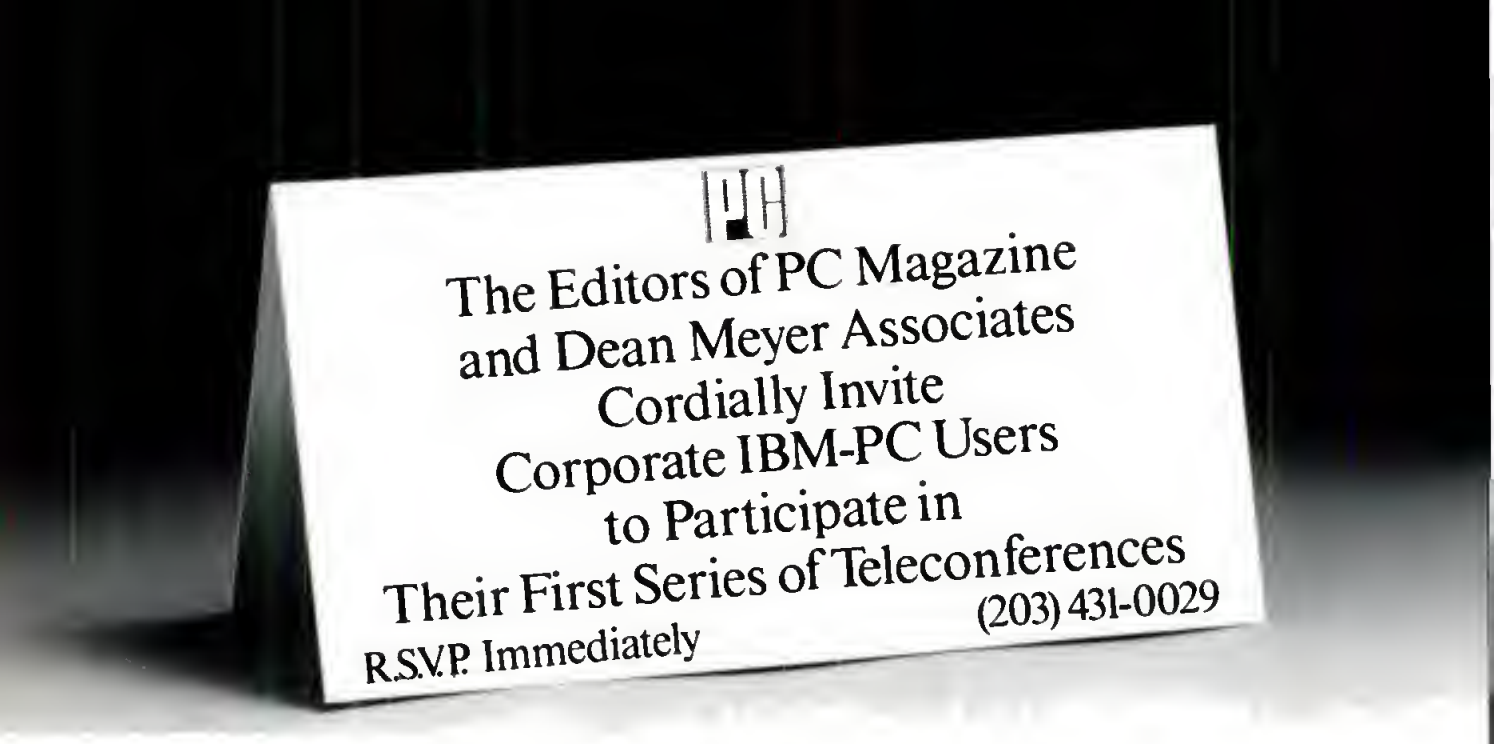

Keep current about the rapid advances for the IBM-PC without having to leave your office.

Ever increasing numbers of corporations using IBM PCs are concerned about their key executives falling behind the required PC "learning curve."

That's why they are sending selected executives to numerous seminars and conferences dealing with hardware and software innovations in desktop computing.

But, if you've ever participated in such a seminar or conference you know that the expense involved in travel and accommodations, the slowdown when key executives are absent from the office for one or more days and other inconveniences make attendance at such programs difficult if not impossible—even though they may prove valuable.

The Teleconferencing Alternative

Teleconferencing—connecting people in different locales by means of audio-quality telephone networks—has come of age. Indeed, as has been widely reported in the business press, teleconferencing techniques have evolved to the point where such programs surpass those that are conducted "residentially." One reason alone is sufficient to illustrate the advantages: teleconferencing seminars attract the very best authorities because they can moderate or participate in the program from the comfort of their own offices.

Now, *PC* Magazine is joining the teleconferencing revolution by combining its editorial resources with those of one of this country's leading office automation management consulting firms. The result is the first series of *PC* Teleforums, co-moderated by *PC* editor, Bill Machrone, and Dean Meyer, President of Dean Meyer & Associates.

Five Teleforums Scheduled

Five PC Teleforums will be conducted in 1985 as follows. (Exact dates are to be determined on the basis of mutual convenience to participating companies.)

March	Integrated Multi-Function Packages (Guest Speaker: Kay Reditt, CogniTech Services Corp)
May	Training Programs for PC Users (Guest Speaker: Ray Hood, MicroTrek, Inc.)
July	Compatibles, Portables and Incompatibility (Guest Speaker: Peter Norton)
October	Long-Term PC-AT Experiences (Guest Speaker to be announced)
December	The Latest Hardware and Software—An Update (Bill Machrone, Editor, PC Magazine)

Limited Participation

To insure continuity and effective participation in the series participation is limited to 16 companies, with each committing to all five programs. (There is no limit to the number of attendees at each company's session. One spokesperson interacts for each company.)

Applications for participation are now being accepted on a first-come, first-served basis. Each participating company will receive a comprehensive set of briefing materials prior to each Teleforum sufficient for its needs.

Briefing materials will include an agenda, case histories, reading and reference materials and supporting documentation. Additionally, each company will receive a full transcript of each forum after the program.

Methodology

No special equipment is required beyond an ordinary telephone jack and "speakerphone". Each Teleforum will be conducted via a high quality audio bridge which we will arrange. The moderator will control the flow of conversation so that there will be no difficulty in presenting questions or receiving responses.

Send for More Information Without Obligation

To receive a complete briefing on PC Teleforums, fill out and mail the coupon below or call (203) 431-0029. We'll answer questions and explain how your participation can serve as the central element of your company's PC education and development program. But we suggest you act promptly—*only 16 companies will be allowed to participate* in the first series and we expect to be fully subscribed very quickly.

Teleforums
c/o Dean Meyer & Associates
223 Mountain Road
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YES! I am interested in learning more about PC Teleforums. Please contact me so that I can receive complete details about my company's participation.

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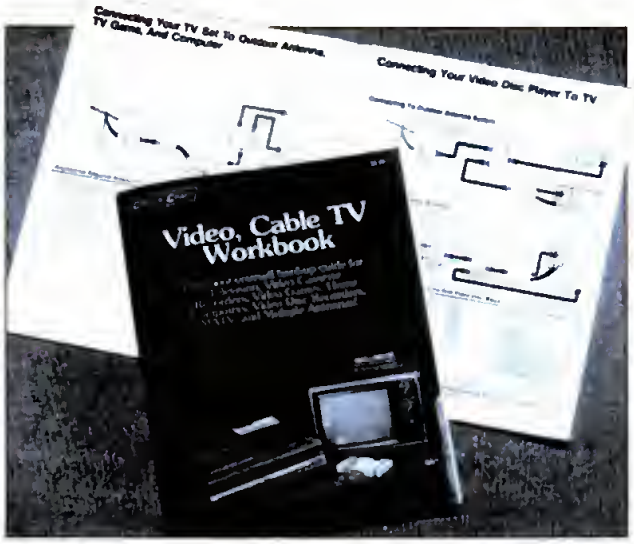

Video, Cable TV Workbook, Carter Craft Corp.

PUBLICATIONS

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A series of booklets written primarily for students, that provide instruction in the various steps involved in producing structured flowcharts and BASIC programs. *Introducing Flowcharts* helps the reader analyze the elements of a programming problem and list the procedures required in a pictorial form. By following structured flowcharts, the reader is taught the methods used by experienced programmers to delineate and analyze the logic of a proposed program.

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1. Please include the retail price, distribution methods, and details of both hardware and software requirements needed for an end-user to properly use your new product. For software especially, this includes required amount of RAM, number and type of disk drives, operating system(s) supported, and any peripheral equipment needed.

2. Releases should be typewritten double-spaced on one side of the paper. Copies of advertisements for the product may be included, but in most instances we need more information about a product than is typically included in an ad.

3. Include telephone contacts for marketing and technical questions.

4. If available, include black-and-white glossy photos of the product, 4 × 5 in. or larger.

Please note that all products are run on a space-available basis. It is impossible to guarantee publication of a product announcement for any particular issue.

Inclusion in New on the Market is at the exclusive discretion of the editor.

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Works like the DOS "DIR" command but does more. SEARCHES/LISTS directories for filenames containing ANY CHARACTER STRING you specify. Searches all sub-directories on a hard disk. Great for hard disk maintenance and housekeeping! PREDICTS how much space your files will occupy on floppy disks. For DOS 2.0 or greater. $35.00. 30 Day money-back Guarantee. MC/VISA/Check accepted
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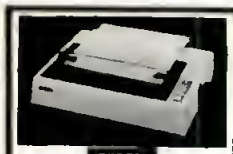

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RX-80, 100 cps, 80 col, tractor Fd — Call
RX-80 F/T, above plus friction Fd — Call
RX-100, above but 132 column — Call
FX-80, 160 cps, 80 column — Call
FX-100, above but 132 column — Call
JX-80 color printer, 160 cps, 80 col — Call
LQ-1500, 200 cps, 136 col, 24-pin — Call
Parallel Interface for LQ-1500 — Call
Serial Interface for LQ-1500 — Call
Tractor for LQ-1500 — Call
Cut Sheet Feeder for LQ-1500 — Call

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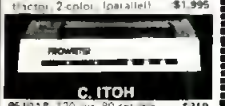
82A, 120 cps, 80 col, Ser & Par — $315
83A, 120 cps, 136 col, Ser /Par — $595
84P, 200 cps, 136 col, Parallel — $759
92P, 150 cps, 80 col, Parallel — $399
93P, 160 cps, 136 col, Parallel — $599
2410P, 350 CPS, 136 col., friction & tractor, 2-color, (parallel) — $1,995



C. ITOH

9510AP, 120 cps, 80 column — $319
8510-SF, above but 180 cps — $499
8510-SCP, above but w/ 3-color ribbon to generate 7 colors — $599
1550, 120 cps, 132 column, Par — $579
1550-SP, above but 180 cps — $809
1950-SCP, above but w/colors — $799
F-10, 40 cps daisywheel, parallel — $899
F-10, 55 cps daisywheel, parallel — $1199
Tractor for F-10 — $225

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Gemini 10X, 120 cps, 80 col — $265
Gemini-15X, above w/132 col — $365
Delta 10, 160 cps, 80 col — $395
Delta 15, above w/132 column — $499
Radix 10, 200 cps, 80 column — $575
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IBM PC COLOR PRINTER

A high speed dot-matrix printer for graphics & text at speed up to 200 cps and up to 6 colors. — Sale! $1,595

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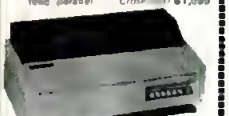
IDS Prism 80C, 200 cps, 80 col, color printer, graphics, tractor & friction feed, parallel — Close-out! $1,095

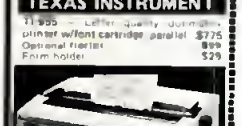


DATAPRODUCTS

8050 — 200 cps, 132 col, RS-232, tractor/friction/tractor feed, parallel — $1,395
8050C — above + colors — $1,499
8070 — 400 cps, 132 col, parallel — $1,695
5070C — above + color — $1,795
200-sheet bin feeder — $789

TEXAS INSTRUMENT

TI 855 — Letter quality dot-matrix printer w/font cartridge, parallel — $725
Optional Font — $99
Font holder — $29



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24-pin print head for highest resolution!
192 cps draft, 100 cps letter quality!
P1351 — 132 column, parallel — $1250
P1340 — above but 80 column — $725
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Bi-Directional Tractor — $199

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C-160 Color Ink Jet Printer — 20 cps, 16-nozzle print head produces 7 solid colors and 5-level of halftones for literally thousands of shades. 136 dot/in. resolution, 12x16-dot text, 8½" print width. Parallel — $1,150
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F32 Tae-bin sheet feeder — $1,199
Diablo P32COI, 160 cps dot matrix — $795
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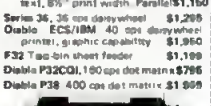

NEC SPINWRITER

prices include thimble & ribbon

3550 — 32 CPS, 203 cpi, proportional space, bi-directional, parallel — $1,449
2050 — Similar to 3550 but 19 cps — $795
7730 — 65 CPS, 203 cpi, parallel — $1649

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H-P LASER PRINTER

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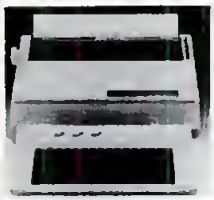

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Made by Brother

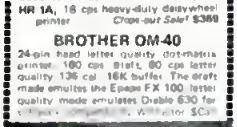
20-cps daisywheel printer, 2 color printing, 13½" paper, parallel — $CALL
Optional Tractor — $99
Optional Keyboard — $159
Optional Cut Sheet Feeder — $189

BROTHER

HR 20, 23 cps daisywheel printer with 2 color printing, 3K buffer — $646
HR-35, 36 cps daisywheel printer — $895
Tractor — $119
Cut sheet Feeder — $199
HR 1A, 18 cps heavy-duty daisywheel printer — Close-out Sale! $350

BROTHER OM-40

24-pin head, letter quality dot-matrix printer, 160 cps draft, 80 cps letter quality, 12K cal. 16K buffer. The draft mode emulates the Epson FX 100, letter quality mode emulates Diablo 630 for software compatibility. Whisper SCA



JUKI

6100 — 16 cps, 13" platen, 2K buffer, parallel — $479
6300 — 40 cps, 132 col, 3K buffer — $795
Tractor — $119

OUME

LetterPro 20, letter quality daisywheel printer, 20 cps, 13" paper — $449

FUJITSU

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Tractor, uni-directional — $199
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Multi-Function Cards for IBM PC and XT

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Memory installed on card →	64K	128K	192K	256K	320K	384K
with parallel, serial ports & clock	$249	$299	$349	$399	$449	$499
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QUADRAM

9 Function memory expansion Card!

Amount of memory installed: 0K, 64K, 128K, 192K, 256K, 320K, 384K
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- Up to 384K
- Game port
- Qswap
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- Parallel port
- Serial port
- QuadRAM drive
- Master spool
- I/O bracket

IDEA

IDEAmax 384 MULTIFUNCTION CARD FOR PC/XT—complete with parallel port, serial port, game port, clock/calendar and software for printer spooler & selection, disk emulation, etc.

0K	64K	128K	192K	256K	320K	384K
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Above w/parallel port — $129
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Maynard WS 1, 10MB hardisk w/Sandstar multifunction card & hard disk controller module — $499
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40 MB harddisk + Backup	$5,399
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Series 3000 Subsystems. Internal hard disk for IBM AT

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Basic unit is a transient surge protector with EMI/RFI filtration. Complete w/ a lighted main switch and three other switches for computer, monitor, printer and one more accessory. Also slots for other options. Basic unit — $199

Options:
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10 MB harddisk — $899
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64K (4164) 150 ns, $4 ea. ... 8 for $30
179K for IBM AT, 200 ns — $20 ea.
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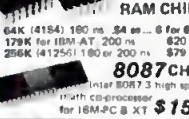

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Intel 8087 3 high speed math co-processor for IBM-PC & XT — $159

IBM compat. D...

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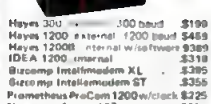
Hayes 1200B internal w/software — $389
IDEA 1200 internal — $319
Bizcomp Intellimodem XL — $395
Bizcomp Intellimodem ST — $355
Prometheus ProCom 1200 w/clock — $225
Novation Access 123 — $399
VenTel Half Card, 1200 baud, fits slot in IBM XT & portable — $425



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P2 — A unique combo isolator and surge protector w/5 lighted and a master rocker switches for your computer & accessories. Also filters out EMI & RFI interferences — $119
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PC-200, 200-watt power supply backup which will take over within 10 milliseconds. Built in surge protector — $299
XT-300, above but 200-watt — $395

IBM PC XT AT

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256K portable, 2 IBM drives — $2,480
256K Portable, 1 IBM drive, 1 10 MB hard disk — $2,795
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100% compatible with the IBM AT. Complete with mounting bracket and cable — Super Low Price — $1,095

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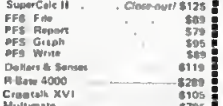
Symphony Upgrade Kit	$149
SYMPHONY	$425
dBASE II	$285
dBASE III	$365
dBASEIII Upgrade Kit	$149
FRAMEWORK	$365
WOROSTAR PRO PAK	$299
WORDSTAR 2000	$325
WORDSTAR 2000+ w/telemerge	$379
Microsoft Word with Mouse	$275
Multiplan	$179
SuperCalc II — Close-out!	$125
FFG File	$89
PFS Report	$79
PFS Graph	$95
PFS Write	$89
Dollars & Sense	$119
R:Base 4000	$289
Crosstalk XVI	$105
Multimate	$795



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Compaq 256K, 2 driver — $2,295
CompaqPlus, 136K, hard disk — $3,795
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High quality rotary selector switches. Fully shield beige metal housing. 2 amp capacity.

DB 25 2S 2V (1 in, 2 out) RS232 DB-25 female connectors — $99.00
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Highest Quality Shielded Cables

Parallel printer cable for IBM PC — $16
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MONITOR SALE

FREE interface cable with all!

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IBM Color Monitor — 12" RGB color, 640x200 dots, 16 colors, black matrix background — *Super low price* $679

Forte FC10, 13" RGB color, 640x200 dots with green switch — $479

PGS HX 12, 12" RGB color, high res 980x200-dot, 16-color — $499

PGS 6R 12, 12" GRB color, super high res, 680x400, w/interface card — $679

NEC JC1216DFA, 12" RGB, 640x300 dot — $439

Taxan 425, 12" RGB color, 560x200 dots with green switch — $459

Taxan 440, 12" super high res RGB color monitor, 720x480 dots. Has green switch. It gives sharpest text and color when used with Persyst 909 board. — Sale $575

Taxan 441 & Persyst 909 Board — $999

GREEN SCREEN

Dynax GM 120, 12", high resolution 600-dot, 20 MHz — $136

IBM Monochrome 12", 720-dot — $255

Roland DG MB 122G, 12" green 19 MHz, hi resolution 720x350 dots, fully compatible with IBM monochrome display card — $179

Taxan 121, 12" green 1000x380 dots, TTL monochrome hi PC mono card w/tilt & swivel stand — $199

CGS 12" green, 720x350 dots, TTL monitor for PC monochrome card — $159

KENDN, 12" green, high res, 800-dot 20 MHz comes with tilt & swivel base, grey cabinet matched the IBM PC — *A steal at only!* $119

AMBER SCREEN

Amtek 300A, 12" amber — $145

Amtek 310A, 12" amber, 800 dots, non-glare screen, runs off IBM monochrome interface board — $179

Dynax AM-121, 12" amber 600-dot hi resolution 20MHz — $139

Princeton MAX 12, 12" amber 720 x 380 dot, runs off IBM monochrome display adapter — $199

Taxan 122, 12" amber 1000x380 dots, TTL monochrome for PC mono card w/tilt & swivel stand — $175

CGS 12" amber, 720x380 dots, TTL monitor for PC monochrome card with tilt & swivel base — $159

Xenon 12" amber hi res, 800-dot w/ tilt & swivel base — $125

All merchandise is brand new & guaranteed. All prices reflect 3% cash discount for full payment by cash, cashier's check/money order. Personal or company checks requires 2–3 weeks to clear. Visa, Mastercard & PO's accepted from qualified customers. COD's accepted with 20% paid deposit plus $3 COD fee. No COD's to Canada or FPO/APO. Shipping/insurance/handling charges: 3% of total order value by UPS Surface, 5% by UPS Air & Parcel Post (Min. $3). Calif. residents add sales tax. No sales tax on out-of-state orders. Prices & availability subject to change without notice.

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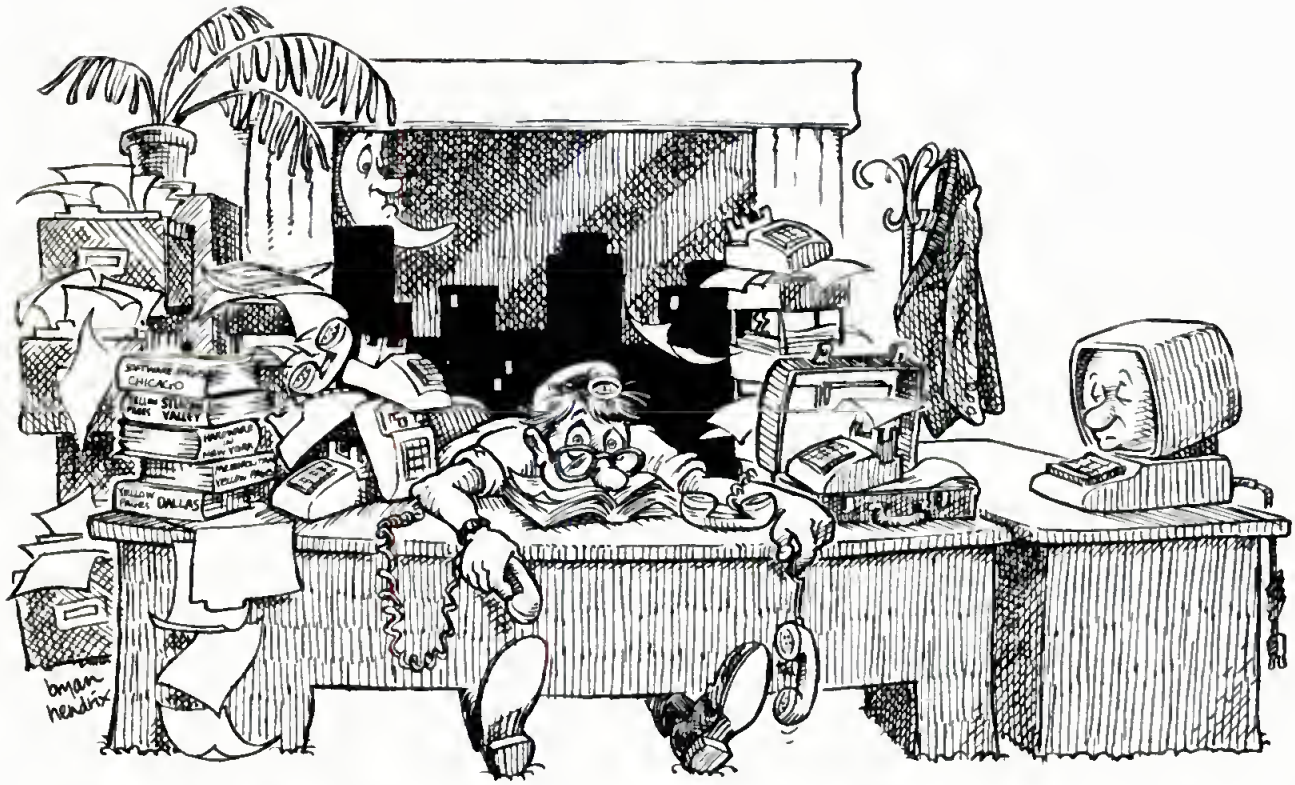

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IBM Professional Debug Facility

Advanced PC users want to know how IBM's high-powered Professional Debug Facility differs from DEBUG. We review this new package.

Concurrent PC-DOS

Digital Research's latest member of the CP/M family, *Concurrent PC-DOS*, is yet another alternative to MS-DOS. Will its multi-tasking and multi-user capabilities be enough to seduce PC-DOS and MS-DOS users? Our review of *Concurrent PC-DOS* suggests an answer.

JRAM for the PC

The JRAM-2 distinguishes itself from competitive memory boards with a design that supports both 64K and 256K chips. Eight JRAM boards used in an expansion chassis can create a 16-megabyte RAMdisk. *Tech Journal* evaluates Tall Tree's package.

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Software Sorting

The little guy in Minnesota has outdone the big guy in New York with a PC software guide. For a comprehensive look at the software marketplace, try the Micro Information version.

It's comforting to know there's a wealth of software for your PC, but how do you find just the program you're looking for? One way is to look through the pages of various magazines and newspapers. Computer vendors seem to advertise in nearly every conceivable publication these days. This practice, however, is no guarantee that you and a particular ad will ever cross paths. Hence the usefulness of software guides.

Several publishers have responded to the need for comprehensive listings of software to help consumers through the software jungle. In this column, I'll review two of the larger guides on the market and in the next issue, two more.

PC FACT FILE

datapro/McGraw-Hill Guide to IBM Personal Computer Software
datapro Research Corporation
1805 Underwood Blvd.
Delran, NJ 08075
(609) 764-0100
McGraw-Hill, Inc.
1221 Avenue of the Americas
New York, NY 10020
(212) 512-2000
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ISBN 0-07-015424-4

CIRCLE 699 ON READER SERVICE CARD

The datapro/McGraw Hill Guide to IBM Personal Computer Software was compiled by datapro Research Corp. in Delran, New Jersey, a subsidiary of McGraw-Hill, the distributor. A long-time compiler and publisher of guides about computer hardware and software, datapro commonly sells to the libraries of major business computer users.

The book is divided into 16 major subjects including accounting, banking and finance, data communications, medical and health care, a section profiling the vendors listed at the beginning, a product index, a vendor index, and a 59-page glossary. The glossary is a handy feature, although it is a bit out of place in a software guide. The vendor listing is also useful, as it gives you some idea of the vendor's size (by number of employees and sales volume).

Most product listings carry at least six types of information, including the following: address and phone number, the product's hardware requirements, source language, pricing, documentation, and brief product descriptions. Some listings carry information on issues such as maintenance provisions, custom modification availability, and training and installation services.

Although the book doesn't state how many vendors or products are listed, I estimate that it includes 636 products and 98 vendors. Only 636 products and 98 vendors? Even though the book was published late in 1983, these numbers seem low considering what's on the market.

Also, like most of these guides, this one carries no edition number. Since these presumably will be updated frequently, I think it would be helpful to institute some sort of edition-numbering system.

To check the thoroughness of these publications, I tried looking up *PC-TALK III* under communications software, and *PC-File* under database management software. These two programs are distributed as "freeware"—that

means you can get the software free or pay for it if you choose to. Both have been well received by the user community. Neither is advertised.

Failed the Acid Test

This publisher failed my test on both counts. And, because the two products were missing, it made me question how many others had been omitted. Although I realize it's difficult for a publisher to gather information on all the software vendors, I think McGraw-Hill could have done a better job. McGraw-Hill has considerable experience in information gathering, vast computer power, and a long history in the publishing field.

Some entries seem to have been listed arbitrarily. Consider the listing for Lotus's *1-2-3*, for instance. It's listed under the Management Science section where it doesn't belong. Why isn't it under accounting or integrated software? Unfortunately, in this book the product index lists products by their proper name only, not by category.

Buy It Today

In contrast, many of the qualities important to a good publication of this sort are found in the *IBM Personal Computer & XT: The Software Guide* from Micro Information Publishing, Inc.

This 1,000-page book, also copyrighted in 1983, lists more than 2,200 products from more than 800 vendors. According to the publisher, the next edition, scheduled for release later this year, will carry significantly more listings of both products and vendors. *The Software Guide* is so comprehensive that I think no PC is complete without a copy of it nearby. Run, don't walk, to your nearest well-stocked computer store to buy it.

All the products listed in this book are divided into 34 major categories, starting

IBM Personal Computer & XT: The Software Guide
Gerald Van Diver
Micro Information Publishing, Inc.
4730 Dakota St.
Prior Lake, MN 55372
(800) 328-0196
Copyright: 1983
Cover Price: $24.95
ISBN 0-912603-00-3

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with agriculture and business, continuing with the industry-specific listings, and finishing with systems software and word processing. Each major heading is further broken down into several subcategories. For example, the Programming Aids/Utilities section includes subheads for compilers, cross-reference programs, debugging tools, sorts, and text editors.

In addition to the listings and descriptions of products, this compilation includes several appendixes: a publisher's reference, which lists, by publisher, all products available from each vendor; a publisher's index, which combines the names, addresses, and phone numbers of software publishers and other vendors; and an alphabetical index, listing products by proper name. The descriptions supplied for each product are lengthy and are at least two or three times longer than those in the McGraw-Hill book.

With all these listings, the publisher rather understated the book's offering by calling it simply a software guide. In addition to software, it also includes listings for monitors, multifunction cards, hard disks, and printer buffers. In my experience, it's the first time I remember a vendor selling me more than I thought I was getting.

The listings carry the publisher's name; program language, operating system, and memory required; category; subcategory; description; and price. Some entries also include sample screen displays and highly detailed examples of printouts. By and large, additional information carried in the McGraw-Hill book, such as maintenance, installation and training, modification availability, and so on, are omitted. Unlike the McGraw-Hill book, this book included *PC-File*, though it flunked on *PC-TALK III*. But, like the McGraw-Hill guide, this book unfortunately indexes software only by proper name and by publisher, and not by generic entry, such as software, integrated; software, systems; software, . . .-communications. Yet it's much less of a deficiency here because of the extensive categories found in the table of contents. Still, I hope the publisher corrects this deficiency in the future and comes up with a genuine index.

If you're planning to buy a software guide, Micro Information Publishing has one of the best on the market. These publishers did the kind of job you would have expected from a high-powered, well-heeled organization such as McGraw-Hill and not from such a small newcomer to publishing. ■

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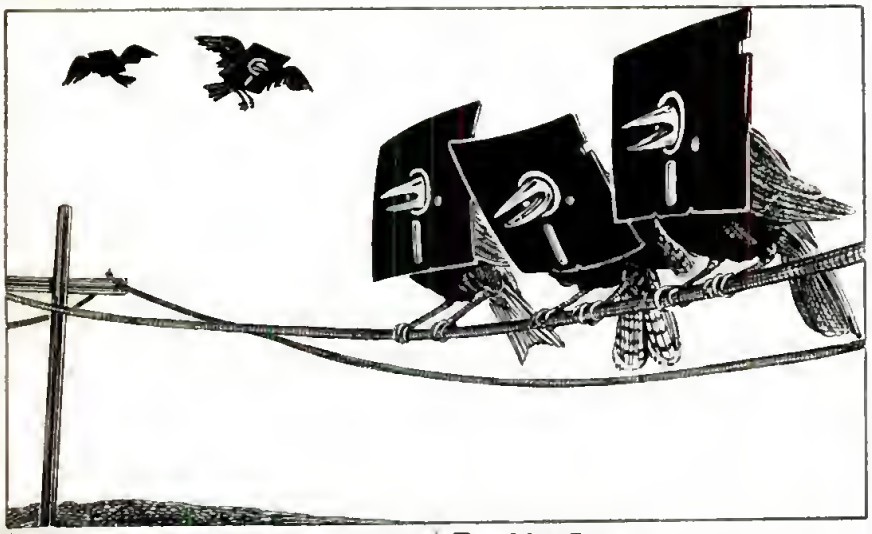
The Urge To Merge

Some users of PC-Talk III have created files that expand the capabilities of this popular communications program. Here's a guide to the most useful merge files around.



If you use your PC for communications, odds are pretty good that you already have a copy of *PC-Talk III*, the most recent official release of the popular user-supported communications program.

You may be surprised to find out, however, that several unofficial versions of *PC-Talk III* are floating around—or several modifications, to be precise.

PC-Talk's author, Andrew Fluegelman, encourages users to modify the program and distribute those modifications with *PC-Talk*. The only restriction is a request that users distribute changes in separate "merge" files instead of incorporating them into the program.

Tracking Bugs

Although most users ignore this request, there are good reasons for following it. The most important is that, in addition to adding features to the program, modifications can add bugs. This is doubly true of modifications that have been written independently of one another and that may interact in unforeseen ways. The easiest way for you to track down such bugs is to start with an unmodified version of *PC-Talk III* and add the modifications one by one until the bugs appear.

Adding the modification files to *PC-Talk III* is done by joining the original *PC-Talk III* file, PC-TALK.BAS, with each merge file, MODFILE.MRG, through the use of the MERGE command in BASIC. This procedure is easy enough to do, even for the most confirmed nonprogrammer.

The first step in adding modification files is to ascertain that each merge file is saved in ASCII format. You can check this with the TYPE command in DOS (TYPE MODFILE.MRG). If the file that scrolls down your screen uses only letters and numbers, it's in ASCII. If it's filled with hearts, faces, and other symbols, it's not. To convert the file to ASCII format, enter the following:

```
BASICA <Return>
LOAD "MODFILE.MRG" <Return>
SAVE "MODFILE.ASC", A
  <Return>
```

The first line loads BASIC, the second line loads the merge file MODFILE.MRG, and the third line saves MODFILE in ASCII format under the name MODFILE.ASC. (I am assuming here that all files are on the logged disk drive. If they are not, add drive names as appropriate.)

Merging Files

Once the files are in ASCII format, merging them is just as easy. Enter:

Illustration: Kimberly Root

```
BASICA <Return>
LOAD "PC-TALK" <Return>
MERGE "MODFILE.ASC" <Return>
SAVE "PC-MOD" <Return>
```

Here again, the first line loads BASIC. The second line loads PC-TALK.BAS, the third line merges MODFILE.ASC into PC-TALK.BAS, and the fourth line saves the newly modified file under the name PC-MOD.BAS. You can then run PC-MOD.BAS using the command BASICA PC-MOD.

If you have the IBM BASIC Compiler, you can compile the modified *PC-Talk III* so it will run faster. To do that, first save the file in ASCII format (SAVE "PC-MOD",A), and then enter

```
BASCOM PC-MOD.BAS
  /E/O/S/C:4096 <Return>
LINK PC-MOD+IBMCOM
  <Return>
```

The options /E/O/S/C will work in most cases, but you may want to check the BASIC compiler manual for further information. The file IBMCOM.OBJ comes with the BASIC compiler.

A Field Guide

Now that you know how to modify *PC-Talk III*, here are some comments on the more popular merge files available on most bulletin boards.

- PCFIXLC1.MRG, written by Leroy Casterline. *PC-Talk III* will let you specify a phone number for a long-distance carrier such as Sprint or MCI. With PCFIXLC1, you can add an account number as well. *PC-Talk III* will then automatically dial your local access number, your account number, and the long-distance number.
- PCFIXLC2.MRG, also by Leroy Casterline and modified by Jim Gainsley. This file adds a command, ALT-H, that will tell your Hayes Smartmodem to hang up the phone. Equivalent files include PTHANG.MRG.
- PCTSPLT.MRG, by Wes Meier. Normally, *PC-Talk III* will send characters one at a time, as you type them. PCTSPLT gives you the option of splitting the screen at the 25th line. This lets you type and edit on the 25th line, then send the whole line at once when you press the Return key. PCT3SC.MRG is an equivalent file.

If you have the IBM BASIC Compiler, you can compile the modified PC Talk III to run faster.

- TALK450.MRG, by Dorn Stickle. Despite anything you've heard to the contrary, 300-baud modems are not limited to a maximum speed of 300 baud. TALK450 modifies *PC-Talk III* so you can use a Hayes Smartmodem at 450 baud, provided the computer at the other end of the line is doing the same. This causes a 10 to 20 percent increase in the number of transmission errors, but a 50 percent increase in transmission speed. Equivalent files include PC450.MRG.
- PCT-365.MRG, by Jim Gainsley. Also known as *PC-Talk, Version 3.65*, this merge file combines a half-dozen modifications, including an improved ALT-H routine for hanging up the modem, a rewritten REDIAL routine, and support for path and subdirectory commands. PCT-366.MRG resolves some bugs that surfaced in PCT-365.
- 3101CMW.MRG, by Kent Galbraith. Galbraith's 3101CMW enables *PC-Talk III* to emulate a 3101 terminal, which opens the possibility for using windows, music, color, and graphics when the system you're talking to is set up to use those capabilities. ANSI.MRG is an equivalent file.

The One for You

- BBS-TALK.MRG, finally, is the merge file you really want. In addition to joining all the above features into a single file, BBS-TALK resolves a number of conflicts among the various files. Furthermore, it adds a few capabilities of its own. BBS-TALK.MRG was written by Dorn Stickle, who deserves much praise for the effort. The later of two versions, dated 8 September 1984, solves a minor bug in the earlier version.

BBS-TALK must be compiled because it must first be joined with three companion machine language files: GETDIR.OBJ and CHDIR.OBJ, both by Jim Gainsley, and DISKSPAC.OBJ, by Dorn Stickle. (GETDIR.OBJ supports the PATH command in DOS; CHDIR.OBJ lets you change subdirectories; DISKSPAC.OBJ tells you how much space is left on your disk.) If you don't have the BASIC compiler, you can find a compiled version on many bulletin boards, but again, it's best to do the merging yourself. When you download BBS-TALK.MRG, get these three companion files, plus BBS-TALK.DOC, "typed" by Greg Rismoen.

BBS-TALK.MRG must be merged with an unmodified copy of PC-TALK.BAS. It will not work with the version of *PC-Talk III* that has been modified to work with Qubié's modems. Unfortunately, this version masquerades under the name PC-TALK.BAS on many bulletin boards. The quickest way to check which version you have is to look at line 6875. The original reads

```
6875 IF MODM$="THEN
  MODM$="ATDT"
```

Consider this a field guide to *PC-Talk III* merge files but don't expect the situation to remain static. Dorn Stickle, for example, tells me that he is working on a modification that will support several models of modems and will add a batch-file feature for automated operation. Stay tuned for further developments. ■

Coming Up

Learn Speed Reading on Your PC

With training, exercises, and lots of practice, you could learn to read at double or even triple your current speed, without sacrificing reading comprehension. Dara Pearlman looks at a trio of software packages that will help you learn to read faster at a cheaper price than that of a traditional course. Pearlman reports that the people who brought you the Evelyn Wood Speed Reading Dynamics course have gotten into the computer software act.

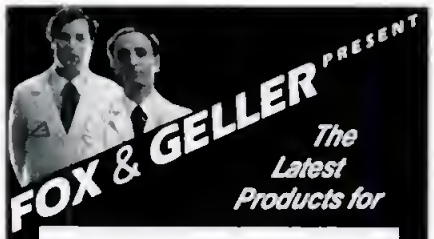
PC Maintenance

Despite the PC's reliability, sometimes things go wrong. You don't have to be a trained technician to find the source of a malfunction. If you can operate a PC, you can diagnose its problems, and in most cases, you can save time and money by fixing the PC yourself. The job isn't as difficult as it might sound. If you leave the computer to its own devices, it will take care of most of the repair. Often, the computer will let you know what is going on (or isn't going on) before it undertakes more serious fix-it work.

In this series, *PC* will explore the ways you can maintain your own PC. In an article based on his book *How to Repair and Maintain Your IBM PC*, Gene B. Williams explains how to overcome circuit board problems. Henry Beechold writes an article on disk drive maintenance and repair, based on a chapter of his forthcoming book, *Maintenance and Repair Guide for PCs and PC Compatibles*. In addition, we'll discuss how you can take care of your PC's peripherals and the value of signing up for the various service contracts that are available for your PC.

SLAMming with the PC

Computer simulations enable scientists to predict the results of various experiments without actually running through them. Jan B. Young will review a new product called *SLAM II* from Pritsker and Associates that promises to help scientists run simulations on an IBM PC or PC-compatible. How well you think *SLAM* works, however, will depend on what you compare it to.



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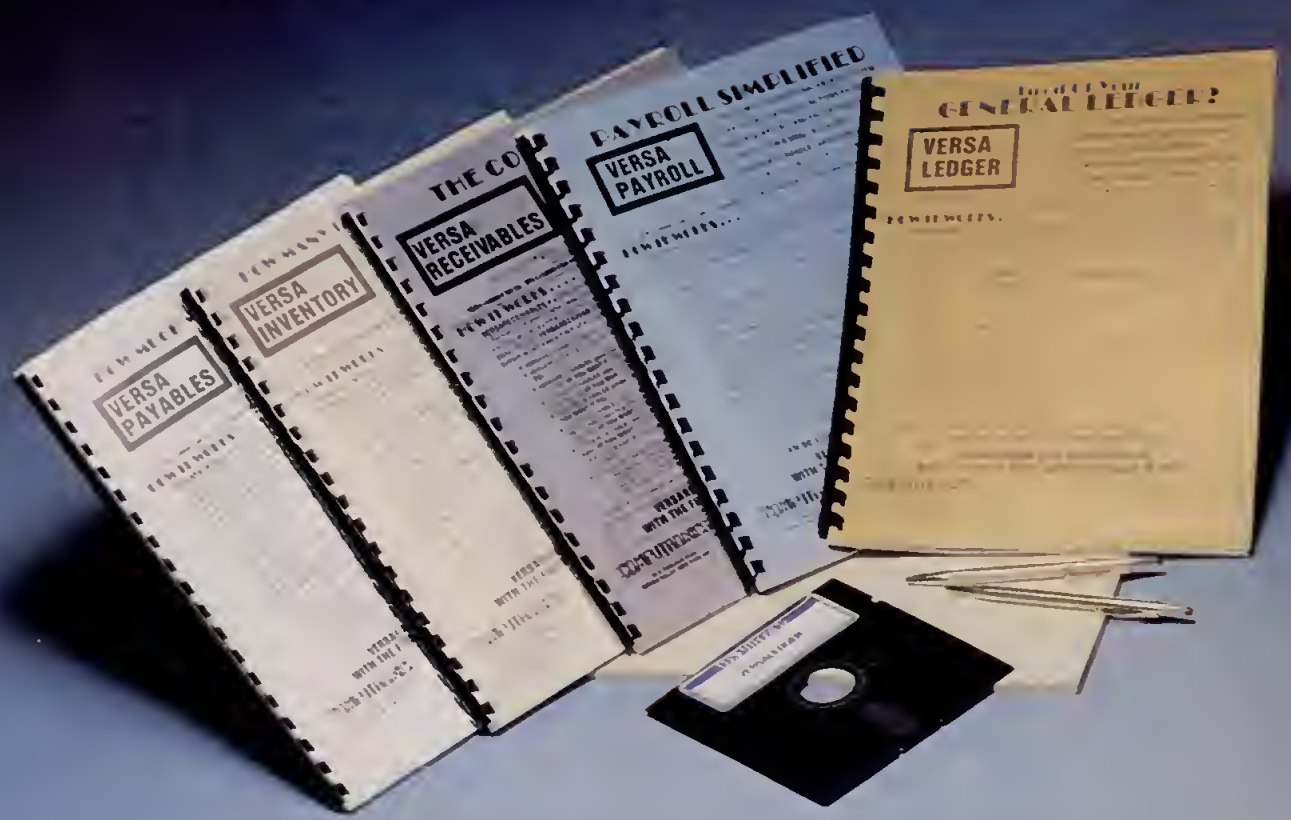

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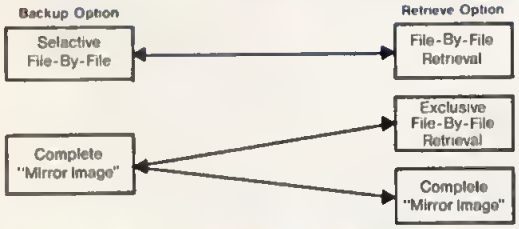

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